n-137-2-005897-----
Engr. Res. & Devel. Bur.
Rm. 600
Bldg. 7A

RECEIVED
NOV 2 0 1986
N.Y.S. DOT
Engrg. Res. & Dev.

MATERIALS BUREAU

MATERIALS METHOD 1

QUALITY ASSURANCE PROCEDURE FOR CONCRETE PIPE ITEMS

SEPTEMBER, 1986

NEW YORK STATE DEPARTMENT OF TRANSPORTATION
MARIO M. CUOMO, Governor
FRANKLIN E. WHITE, Commissioner

NEW YORK STATE DEPARTMENT OF TRANSPORTATION MATERIALS BUREAU ALBANY, NY 12232 **MATERIALS METHOD**	MATERIALS METHOD: N.Y. 1 ISSUE DATE: September, 1986 Supersedes: MM N.Y. 1 dated 4/17/72
SUBJECT: QUALITY ASSURANCE PROCEDURE FOR CONCRETE PIPE ITEMS	
APPROVED: James J. Murphy JAMES J. MURPHY, DIRECTOR, MATERIALS BUREAU	CODE: 7.42-1-1

I. Scope

This method describes specific procedures for the quality assurance of the following items manufactured for Department projects:

Non-Reinforced Concrete Pipe
Reinforced Concrete Pipe
Reinforced Concrete Elliptical Pipe
Porous Concrete Pipe Underdrain
Extra Strength Porous Concrete Pipe Underdrain
Reinforced Concrete Pipe End Sections
Reinforced Concrete Cattle Pass

It encompasses combinations of various control systems including certification, inspection, sampling and testing.

II. Contents

		Page
I.	Scope	1
II.	Contents	1
III.	General Method	3
IV.	Definitions	4
V.	Evidence of Acceptability	9
VI.	Inspector's Responsibilities	9
VII.	Drawing Approval for Concrete Pipe Items	11
VIII.	Proof of Design	12
IX.	Production Inspection	13
X.	Monitor Sampling	17
XI.	Sampling For Acceptance Consideration of Pipe Items In Stock Lot Quantities	19
XII.	Acceptance Testing	25
XIII.	Acceptance/Rejection Action	28
XIV.	Shipment And Evaluation of Pipe At The Project Site	30

(con't)

NYSDOT
Library
50 Wolf Road, POD 34
Albany, New York 12232

II. Contents (con't)

		Page
XV.	Inventory Control	32
XVI.	Acceptance of Pipe From Commercial Inventory ...	34

Appendices

1. Reinforced Concrete Pipe Classes II, III, IV, V Three-Edge-Bearing Test Loads 35
2. Horizontal Elliptical Reinforced Concrete Pipe Classes HE II, HE III, HE IV Three-Edge-Bearing Test Loads 42
3. Vertical Elliptical Reinforced Concrete Pipe Classes VE IV, VE V, VE VI Three-Edge-Bearing Test Loads 45
4. Non-Reinforced Concrete Pipe Three-Edge-Bearing Test Loads 48
5. Porous and Extra-Strength Porous Concrete Pipe Underdrain Three-Edge-Bearing Test Loads 49
6. Test Method - Three-Edge-Bearing Test 51
7. Three-Edge-Bearing Test Flow Chart 59
8. Test Method - Infiltration Rate Test 60
9. Criteria for Field Inspection of Pipe 62
10. Test Method - Determination of Area of Reinforcement in Reinforced Concrete Pipe ... 67
11. Wire Size Comparison 71
12. Examples of BR240, Sample and Acceptance Transmittal and Three-Edge Test Results 72
13. Example of Properly Completed BR97, Shipment Certification 75
14. Example of Properly Completed BR240 For Reinforced Concrete Pipe End Sections ... 76
15. Random Number Table 77

III. General Method

A. This method details the system used to assure the quality of the following concrete pipe items:

Non-Reinforced Concrete Pipe
Reinforced Concrete Pipe
Reinforced Concrete Elliptical Pipe
Porous Concrete Pipe Underdrain
Extra Strength Porous Concrete Pipe Underdrain
Reinforced Concrete Pipe End Sections
Reinforced Concrete Cattle Pass

The Materials Bureau evaluates the manufacturer's drawings detailing pipe items to be produced and the manufacturing facility. After a satisfactory review, an Inspection Authority is assigned by the Materials Bureau to provide inspection at the manufacturing facility. This shall include: random inspection during production, selection of samples for testing, the witnessing of tests and the evaluation of the finished product to determine specification compliance.

The test properties required to determine the acceptability of the concrete pipe items depend on the specification requirements for that item and include one or more of the following: air content, infiltration rate, absorption and three-edge-bearing strength.

For Reinforced Concrete Pipe End Sections, the air content of the concrete is determined on cores drilled by the Manufacturer from units randomly selected by the Department representative (Plant Inspector) and tested by the Materials Bureau.

For Porous Concrete Pipe Underdrain and Extra Strength Porous Concrete Pipe Underdrain, an infiltration rate is determined on samples randomly selected by the Plant Inspector and tested by the Manufacturer with that testing witnessed by the Plant Inspector.

The three-edge-bearing strength is required on the following pipe items:

Non-Reinforced Concrete Pipe
Reinforced Concrete Pipe
Reinforced Concrete Elliptical Pipe
Porous Concrete Pipe Underdrain
Extra Strength Porous Concrete Pipe Underdrain

The test is performed on samples randomly selected by the Plant Inspector and tested by the Manufacturer, with that testing witnessed by two Plant Inspectors.

The absorption property of the concrete is evaluated on the following pipe items:

Non-Reinforced Concrete Pipe
Reinforced Concrete Pipe
Reinforced Concrete Elliptical Pipe
Reinforced Concrete Cattle Pass

The evaluation will be made by testing performed on cores drilled by the Manufacturer from units randomly selected by the Department representative and tested by the Materials Bureau. When it has been determined that the Manufacturer has established satisfactory quality control to assure the Department that the concrete pipe item produced conforms to the specification requirement for absorption, that test will not be required for acceptance consideration of the pipe.

Subsequent to the evaluation of the test results and acceptance by the Department, the Manufacturer may ship the pipe to Department projects. The pipe will be subject to further inspection by the Department project staff at the project site.

IV. Definitions

A. Manufacturer - A company actually engaged in the production of concrete pipe at a given location.

B. Department - The New York State Department of Transportation.

C. Region or Regional Office - One of eleven subdivisions of the New York State Department of Transportation, under the direction of an individual entitled the Regional Director.

D. Materials Bureau - A facility of the New York State Department of Transportation which may be contacted by mailing to:

Director, Materials Bureau
New York State Department of Transportation
Building 7A - Room 200
1220 Washington Avenue
Albany, New York 12232

or by telephoning the Materials Administration Office of the Materials Bureau at (518) 457-5642.

E. Region Materials Engineer - A representative of the New York State Department of Transportation whose primary function is to assure the quality of materials used in construction in that Region.

F. Inspection Authority - An office designated by the Materials Bureau as responsible for inspection control on behalf of the Department at specific manufacturing locations. The office will be one of the following:

1. The Department's Regional Materials office, supervised by the Materials Engineer.
2. Agency Inspection, supervised by the Materials Bureau or its designee.

G. Plant Inspector or Inspector - An individual employed by the Inspection Authority to function on inspection assignments on behalf of the Department.

H. Project Inspector - An individual assigned by the Department's Project Engineer to function on inspection assignments at the project.

I. Concrete Pipe or Pipe - Terms used to refer to any or all of the following items: Non-Reinforced Concrete Pipe, Reinforced Concrete Pipe, Reinforced Concrete Elliptical Pipe, Porous Concrete Pipe Underdrain, Extra Strength Porous Concrete Pipe Underdrain, Reinforced Concrete Pipe End Sections, Reinforced Concrete Cattle Pass.

J. Elastomeric Gasket - An elastomeric material used to seal the joints of pipe.
Note: The quality assurance procedure for elastomeric gasket is detailed in Materials Method N.Y. 1.1.

K. Lot - A lot shall consist of a number of concrete pipe sections of a single item manufactured at the same location at substantially the same time under similar manufacturing conditions. Any changes in the source of fine aggregate and/or coarse aggregates, size or configuration of the steel reinforcement, cement type or manufacturing methods will necessitate a change in the lot. If production is discontinued for a period of ten working days, a new lot shall be assigned upon resumption of production.

The following chart further defines the composition of a lot:

Pipe Item	Maximum Number Of Sections In Lot
Non-Reinforced Concrete Pipe	500
Reinforced Concrete Pipe	500
Reinforced Concrete Elliptical Pipe	500
Porous Concrete Pipe Underdrain	2000
Extra Strength Porous Concrete Pipe Underdrain	2000
Reinforced Concrete Pipe End Sections	10
Reinforced Concrete Cattle Pass	150

With the exception of Reinforced Concrete Pipe End Sections, a lot shall be composed of sections of the same diameter.

L. Lot Number - A unique number assigned by the Manufacturer to identify the manufacturer's production to be considered for acceptance and destined for Department Contracts. The Manufacturer shall start with the number 1 at the beginning of each calendar year and number consecutively throughout the year. This number should be preceded by the last two digits of the year (i.e. the first lot in January of 1986 will be identified as NYS DoT Lot 86-1, the second lot NYS DoT Lot 86-2, etc.).

M. Working Drawings - Drawings required by the specification shall be prepared by the Manufacturer as detailed below:

1. Cut to a standard 22 by 36 inch size.
2. Margin lines ½ inch from the top, bottom and right hand edges and 2 inches from the left hand edge.
3. A space 3 inches by 11 inches (11 inch dimension parallel to the length of the sheet) in the lower right hand corner for title and approved signature.
4. Eight inch by three inch space (eight inch dimension parallel to the length of the sheet) for notes on possible revisions.
5. Identified by a consecutive numbering system that will permit revision numbers.

Note: The Manufacturer shall supply additional prints of the original drawing at the request of the Materials Bureau.

N. Domesticity - Department contract documents may contain provisions requiring domestic steel. Many concrete pipe items contain reinforcing steel; therefore, if there are domesticity requirements in the contract, they may apply to concrete pipe items. The specific definition for domestic steel is detailed in Engineering Bulletin 83-10 and is repeated herein:

- All steel manufacturing processes must be domestic. The ore, scrap and pig iron may be foreign or domestic; however, transformation into steel and all subsequent processes and fabrication must be domestic.

Acceptable statements to document the domesticity of pipe items are:

Domestic - Conforms to MM NY1
OR
Foreign - Does Not Conform to MM NY1

Note: EB83-10 may be substituted for MM NY1.
MM NY1 abbreviates Materials Method NY 1.

O. Manufacturer's Certification - An official document issued by the Manufacturer, on company letterhead, which shall include the following details for each lot:

1. Date of execution of the certification.
2. Manufacturer's name and location.
3. Type, diameter, class (applicable to reinforced concrete pipe and elliptical pipe only), wall designation (applicable to reinforced concrete pipe only), length and number of sections in the lot.
4. New York State Department of Transportation item number for the pipe item.
5. New York State Department of Transportation lot number.
6. The period of production.
7. The source number, name, location, and test number for each aggregate used.
8. The brand and type of cement used and where it was manufactured.
9. The name and location of the reinforcement manufacturer and the date of his certification for the reinforcement.
10. The type of reinforcement used and
    a. For reinforcing bars, the number size and spacing
    b. For plain wire, the gage(s)
    c. For welded wire fabric, the gage and spacing for each style of fabric, with inner and outer cages indicated.

    Note: For those manufacturers who produce fabric from plain wire, prior approval of the manufacturing process is required by the Materials Bureau
11. Method of curing.
12. Drawing number and date approved.

13. The elastomeric gasket to be supplied including the type, and for "o-ring" the cross section diameter of the elastomer.
14. A statement that the steel is domestic and conforms or does not conform to the domestic requirements of MM NY1. ("Domestic Conforms to EB83-10" will also be an acceptable statement.)
15. A statement attesting that the pipe item was manufactured in accordance with the respective specifications and only Department approved materials were used.
16. The certification shall be signed by an officer of the company having legal authority to bind the company.

P. Red Tape Seal - A red tamperproof tape seal imprinted "NYS DoT SAMPLED" used to insure content security of packages. These seals are furnished to the Inspector by the Department.

Q. Forms - The following forms are published and issued by the Department for use by the Materials Bureau, Inspection Authorities and Manufacturers.

1. BR240, Sample and Acceptance Transmittal - This form is used to identify the concrete pipe item and the sample randomly selected by the inspector representing that item. Subsequent to the completion of testing and evaluation, the form is validated or signed by an authorized Department representative and conveys the acceptance action to the inspector.
2. BR241, Transmittal Envelope - This is a heavy duty envelope used to contain the Form BR240.
3. BR97, Shipment Certification - This form executed by the Manufacturer, certifies the contents of the shipment it accompanies is approved by the Department and serves as a portion of the Evidence of Acceptability. The form is filled out in quadruplicate; one copy accompanies the shipping vehicle, one copy is retained by the Manufacturer, the original and one copy are sent to the Inspection Authority who verifies the accuracy of the information before validation and transmittal to the project site.
4. BR259, Record of Shipment - This form is used by the Manufacturer to maintain inventory control of accepted lots of concrete items.
5. BR280, Cement Shipment Certification - This form accompanies shipments of cement to the pipe plant from a cement mill approved to produce and supply cement under a certification program. This form certifies that all the cement in the shipment was tested for, and conforms to, Department specification requirements.
6. BR44, Cement Shipment Authorization - This form accompanies shipments of cement to pipe plants from a cement mill approved to supply cement under a program of Department inspection. The form indicates that the cement is from Department accepted stock and the shipment was authorized by an Inspector.

V. Evidence of Acceptability - The procedures used by the Department to determine the acceptability of pipe at the manufacturing plant and project location.

A. Pipe at the Manufacturing Plant - A green copy of Form BR240 in the possession of the Manufacturer properly noted with the word "Accepted" and validated by the Materials Bureau or signed by an authorized Department representative.

B. Pipe at the Project Location

1. For installation
   a. A properly completed BR97, Shipment Certification shall arrive with each shipment. The form must properly identify the shipment and contain the test number and date of acceptance.
   b. Each section of pipe shall be stenciled with the following minimum information.
      1. Name or trademark of manufacturer
      2. Date of manufacture
      3. NYS DoT Lot Number ("NYS DoT...")
      4. Wall designation (applicable to reinforced concrete pipe only)
      5. Class (applicable to reinforced concrete pipe and elliptical pipe only)
      6. Diameter
2. For Payment
   a. Copy of Form BR97 which has been validated by an authorized representative of the Inspection Authority.

Note: The validated copy of Form BR97 should be received at the project within three weeks after the shipment. If not received in this time, notify your Regional Office.

VI. Inspector's Responsibilities

This method details the specific responsiblities of Plant and Project Inspectors, among others, to assure the Department receives concrete pipe items conforming to the specification requirements. An index of those duties along with the documents and equipment required to perform those duties are detailed below.

A. Plant Inspector

1. Documents required
   a. Manufacturer's approved working drawings
   b. Specification
   c. Materials Method N.Y. 1
   d. Part 2-A of MURK (Materials Inspection Manual)
   e. Approved List
   f. Aggregate Source Book

A. Plant Inspector (con't)
2. Equipment required
a. Crack gage
b. Micrometer
c. Tape Measure
d. 16 oz. Hammer
3. Index of duties:

Task	Section	Page
Proof of Design	VIII C-E	12
	VIII G, H	12
Production Inspection	IX F-P	15
Monitor Sampling	X C	17
Sampling for Acceptance	XI E-K	20
	XI N-P	23
Acceptance Testing	XII A1-A3	25
	XII B1-B3	26
	XII C1, C2	27
	XII D1, D2	27
Acceptance/Rejection Action	XIII A-D	28
Inventory Control	XV C-E	33

B. Project Inspector
1. Documents required
a. Specification
b. Materials Method N.Y. 1
c. Part 2-A of MURK (Materials Inspection Manual)
2. Equipment required
a. Crack gage
b. Tape Measure
c. 16 oz. Hammer
3. Index of Duties

Task	Section	Page
Shipment and Evaluation	XIV E-H	31
	XIV M, N	32

VII. Drawing Approval For Concrete Pipe Items

Responsibility	Action
Manufacturer	A. Prepares working drawings in the format detailed in Section IV. M, Definitions.
	B. Submits two prints of the working drawing to the Materials Bureau.
Materials Bureau	C. Reviews the working drawings and indicates the necessary corrections on the prints.
	D. Returns one print to the Manufacturer.
Manufacturer	E. Makes all required changes on the original drawing.
	F. Submits five new prints to the Materials Bureau for final approval.
Materials Bureau	G. Reviews working drawing. 1. Indicates approval by sending three prints, signed by the Director, Materials Bureau, to the Inspection Authority. 2. Indicates disapproval by returning the drawing to the Manufacturer unsigned with reasons for disapproval indicated. 3. Indicates tentative approval for drawings requiring proof of design by sending the Inspection Authority three prints signed by the Director, Materials Bureau with a letter reminding the Manufacturer that full approval will not be given until two lengths of pipe for each size and class are manufactured and tested as detailed in Section VIII, Proof of Design.
Inspection Authority	H. Receives the three prints of the approved or tentatively approved drawings. 1. Transmits one print to the Manufacturer. 2. Retains two prints, one to remain on file and the other to be used by the Plant Inspector during inspection calls.

VIII. Proof of Design - The Manufacturer may submit drawings detailing alternates to the specified reinforcement and/or wall thickness for consideration. If considered acceptable, they will be tentatively approved. To gain full approval, these additional steps shall be followed:

Responsibility	Action
Manufacturer	A. Notifies the Inspection Authority at least seven days prior to the manufacture of the two lengths of pipe for each size and class requiring proof of design as detailed on the tentatively approved drawing.
Inspection Authority	B. Assigns a Plant Inspector and provides him with a copy of the tentatively approved drawing.
Plant Inspector	C. Witnesses the manufacture of the two lengths of pipe and verifies conformance to the details shown on the drawing.
	D. Evaluates the Evidence of Acceptability of the materials used in the manufacture of the pipe to assure specification compliance.
	E. Selects samples to monitor the quality of the welded wire fabric used in the manufacture in accordance with Section X Monitor Sampling.
Manufacturer	F. Provides the Plant Inspector with the Manufacturer's Certification for the pipe produced.
Plant Inspector	G. Evaluates the certification as detailed in Section XI, Sampling for Acceptance Consideration of Pipe Items In Stock Lot Quantities, E and F.
Manufacturer, as Witnessed by <u>two</u> Plant Inspectors	H. Performs the Three-Edge-Bearing Test in accordance with the procedure detailed in Appendix 6 on each of the two lengths of pipe. The 0.01" crack strength <u>and</u> the ultimate strength of each of the two units shall be determined.

Responsibility	Action
Inspection Authority	I. Submits a written report to the Materials Bureau detailing the following: 1. The identification of the monitor sample of welded wire fabric, i.e. BR240 Serial Number. 2. A statement indicating exact conformance of the pipe to the details on the tentatively approved drawing. 3. A report of the Three-Edge Test results including the 0.01" crack strength, ultimate strength and names of the two Plant Inspectors who witnessed the testing. 4. The Manufacturer's Certification including a statement by the Plant Inspector that the report was reviewed and contains all of the correct and required information.
Materials Bureau	J. Evaluates the report and the quality of the welded wire fabric monitored during production.
	K. If acceptable, the drawing is given full approval and is indicated as such on the drawing copy on file. This action is documented, in writing, to the Inspection Authority and the Manufacturer.
	L. If the alternate details are not approved, the reasons for disapproval are documented, in writing, to the Inspection Authority and Manufacturer.

IX. Production Inspection - The Inspection Authority will provide random inspection during the production of concrete pipe items. The Plant Inspector shall have free access to the manufacturing facility.

Responsibility	Action
Manufacturer	A. Notifies the Inspection Authority of the proposed period of production of a lot of concrete pipe intended for Department use. This notification shall be made at least 48 hours before the start of production.

Responsibility	Action
Manufacturer	B. Assigns a NYS DoT Lot Number to the pipe in accordance with the lot definition. 1. Consecutive lot numbers are assigned regardless of pipe item, starting with the number one at the beginning of each calendar year. 2. The lot number shall be preceded with "NYS DoT ..." and the last two numbers of the calendar year e.g. "NYS DoT 86-1" for the first lot number in 1986.
	C. Produces, during the proposed time, a lot of concrete pipe in accordance with an approved working drawing and Department specifications.
	D. Marks indelibly, before or as the sections are stockpiled, the inside of the barrel of each pipe section with the following information: 1. Name or trademark of the Manufacturer. 2. Date of manufacture. 3. NYS DoT lot number. ("NYS DoT...") 4. Diameter 5. Class (Applicable to reinforced concrete pipe and elliptical pipe only). 6. Wall designation as detailed in ASTM C76 (applicable to reinforced concrete pipe only). Note: Pipe diameters of 18" or less shall be marked on the inside or outside of the barrel at the discretion of the manufacturer.
Inspection Authority	E. Schedules a Plant Inspector to conduct visits to the plant in order to observe production methods and select samples. The frequency and duration of the visits during production shall be carefully evaluated and determined by the Inspection Authority.

Responsibility	Action
Plant Inspector	F. Acquires and has in his possession, at the minimum, the following documents and equipment to assist in the evaluation of the pipe at the plant. 1. Manufacturer's approved working drawings. 2. Specification. 3. Materials Method N.Y. 1. 4. Part 2-A of MURK (Materials Inspection Manual). 5. Approved List. 6. Aggregate Source Book. 7. Crack gage 8. Micrometer 9. Tape Measure 10. 16 oz. Hammer
	G. Arrives at the plant and secures from the Manufacturer a list of the materials to be utilized in the pipe production. This list shall include all of the materials to be detailed in the Manufacturer's Certification.
	H. Evaluates the acceptability of the materials as referenced in Part 2-A of MURK, the Materials Inspection Manual. If any of the materials do not have the proper evidence of acceptability, the Manufacturer and Inspection Authority will be notified immediately. Concrete pipe items will not be considered for acceptance when manufactured with materials not evidenced as acceptable.
	I. Verifies the compatibility of the cement and aggregates. This compatibility is based on the alkali content of the cement and the potential reactivity with the aggregates. High alkali cements (alkali content greater than 0.70% as designated with an asterisk in the Department's Approved List, titled "Portland Cement") are not to be combined with those aggregates bearing an "x" in the column entitled "Req. Cem. Alk. 0.70% or less" in the Aggregate Source Book. Low alkali cements (alkali content less than or equal to 0.70%) may be used in combination with any Department approved aggregates.

Responsibility	Action
Plant Inspector	J. Verifies that the steel reinforcement placed in the pipe items being produced conform to the approved drawings. This shall also include the verification of the minimum area of reinforcement. The method of calculating that area is detailed in Appendix 10. Note: The reinforcement shall not be coated with oil.
	K. Verifies that the materials listed by the Manufacturer to be utilized in the pipe manufacture are used.
	L. Verify the concrete mix design conforms to that shown on the approved drawing.
	M. Verify that the forms are clean and properly assembled.
	N. Verify the pipe is cured in accordance with the specification.
	O. Verify the finished pipe conforms to the shape and dimension shown on the working drawing.
	P. Verifies each section of pipe is indelibly marked on the inside of the barrel prior to stockpiling with the following information: 1. Name or trademark of the Manufacturer. 2. Date of manufacture. 3. NYS DoT lot number. ("NYS DoT ...") 4. Diameter. 5. Class (Applicable to reinforced concrete pipe and elliptical pipe only). 6. Wall designation as detailed in ASTM C76 (Applicable to reinforced concrete pipe only). Note: Pipe diameters of 18" or less shall be marked on the inside or outside of the barrel at the discretion of the manufacturer.

X. Monitor Sampling

The quality of welded wire fabric used in the manufacture of pipe items and/or cores representing the pipe will be sampled and tested to monitor the effectiveness of the respective quality assurance program.

The test results of these samples are not required prior to the Inspection Authority's acceptance/rejection action.

Responsibility	Action
Inspection Authority	A. Assigns a Plant Inspector to obtain monitor samples at the pipe manufacturing facility.
	B. Maintains a record of welded wire fabric and pipe cores for absorption testing that have been monitor sampled. Samples of the above are required from the initial production of each Manufacturer each year. If the Manufacturer does not produce pipe items for the Department for a period of sixty days or more, monitor samples will be required at the resumption of production. For those Manufacturers with reasonable continuous production throughout the year, monitor samples will be selected a minimum of three times. The Department may increase this frequency as necessary.
Plant Inspector	C. Randomly selects samples at the above rate and submits them with appropriate Department sample transmittals as detailed below. Note: See Appendix 14 for Random Number Table.

Material	Sample Size	Form
Welded Wire Fabric	4 specimens including 1 specimen of the longitudinal member and 3 specimens of the circumferential components. (Each specimen shall be 3 feet in length, identified and tagged)	BR240

Material	Sample Size	Form
Pipe Cores For Absorption Testing	Three cores from each of two lots. Each core shall be selected from a different length of pipe	One BR240 and a copy of the Manufacturer's Certification for each lot

NOTE: Monitoring of absorption testing is not required on pipe manufactured by companies required to submit cores for testing on each lot produced.

Responsibility	Action
Materials Bureau	D. Tests and evaluates the quality of the samples. E. Reports the results to the Inspection Authority. F. Determines the appropriate action. If the results are satisfactory, no further action is required. If they are unacceptable, the action may include one or more of the following: 1. Discuss the results with the pipe manufacturer and the manufacturer or supplier of the product. 2. Evaluate additional material. 3. Determine the extent of the problem and reevaluate the acceptability of the pipe items in which the unacceptable item was included. 4. Evaluate the ability of the Manufacturer or Supplier to provide materials conforming to the specification. 5. Evaluate the effectiveness of the quality assurance program for that product.

Responsibility	Action
Inspection Authority	G. Reports results of testing to the pipe Manufacturer.

XI. Sampling For Acceptance Consideration of Pipe Items in Stock Lot Quantities

Responsibility	Action
Manufacturer	A. Completes the manufacture of the pipe item providing sufficient quality control to assure specification compliance. This quality control shall provide for the evaluation of the pipe for workmanship, including the evaluation of cracks and other defects.
	B. Notifies the Inspection Authority that the pipe production is complete, properly certified and requests Department acceptance consideration.
Inspection Authority	C. Assigns a Plant Inspector to sample and evaluate the concrete pipe item.
	D. Provides to the Plant Inspector, at the minimum, the following documents and equipment to assist in the evaluation of the pipe: 1. Manufacturer's approved working drawings 2. Specification 3. Materials Method 4. Part 2-A of MURK (Materials Inspection Manual) 5. Approved List 6. Aggregate Source Book 7. Crack Gage 8. Micrometer 9. Tape Measure 10. 16 oz. Hammer

Responsibility	Action
Plant Inspector	E. Arrives at the plant and secures the Manufacturer's Certification representing each of the lots to be considered for acceptance.
	F. Evaluates the Manufacturer's Certification for accuracy and completeness. This shall include the verification that it contains the following minimum information: 1. Date of execution 2. Manufacturer's name and location 3. Type, diameter, class (applicable to reinforced concrete pipe and elliptical pipe only), wall designation (applicable to reinforced concrete pipe only) of units 4. Number and length of units 5. New York State Department of Transportation Item Number 6. Period of production 7. New York State Department of Transportation lot number (designated "NYS DoT ...") 8. The name and location of the reinforcement manufacturer, the date of his certification for the reinforcement, and a statement as to the domesticity of the steel Note: If the pipe manufacturer certifies the steel as not conforming to the domesticity requirements, acceptance consideration will not be given without the approval of the Director, Materials Bureau. 9. A statement attesting that the pipe item was manufactured in accordance to the respective specifications and only Department approved materials were used 10. The certification is signed by a representative of the company

Responsibility	Action
Plant Inspector	G. Evaluates the Manufacturer's Certification for specification conformance. This will require the following action: 1. Determine if the source number, name, location and test number for each aggregate used and listed appears in the Aggregate Source Book. (The Regional Materials Engineer should be consulted for current data concerning additional or deleted sources and revised test information.) 2. Determine if the brand and type of cement used and its manufacturing location appear in the Approved List. 3. Verify the compatibility of the cement and aggregates. This compatibility is based on the alkali content of the cement and the potential reactivity with the aggregates. High alkali cements (alkali content greater than 0.70% as designated with an asterisk in the Department's Approved List, titled "Portland Cement") are not to be combined with those aggregates bearing an "x" in the column entitled "Req. Cem. Alk. 0.70% or less" in the Aggregate Source Book. Low alkali cements (alkali content less than or equal to 0.70%) may be used in combination with any Department approved aggregates. 4. Verify the steel meets or exceeds the minimum area per foot of pipe as detailed on the approved drawing. This can be accomplished by using the procedure detailed in Appendix 10. 5. Verify the method of curing conforms to the specification requirements. 6. Verify the drawing number and approval date matches the Plant Inspector's copy.

Responsibility	Action
Plant Inspector	7. Determine if the type of gasket to be supplied conforms to the shape and size (cross section diameter for "o-ring") on the approved drawing.
	H. If the certification is not acceptable, the Plant Inspector shall notify the Manufacturer and discontinue consideration until the appropriate resolution.
	I. If the certification is acceptable, verifies that the pipe in the lot is indelibly marked on the inside of the barrel with the following information: 1. Name or Trademark of the Manufacturer 2. Date of Manufacture 3. NYS DoT Lot Number ("NYS DoT...") 4. Diameter 5. Class (Applicable to reinforced concrete pipe and elliptical pipe only) 6. Wall designation as detailed in ASTM C76 (applicable to reinforced concrete pipe only) Note: Pipe diameters of 18" or less shall be marked on the inside or outside of the barrel at the discretion of the manufacturer.
	J. Examines the pipe for conformance to the specifications for workmanship, cracks and other defects. Criteria for inspecting pipe may be found in Appendix 9. Note: Complete inspection of the pipe in the stockpile is not required. For safety reasons only easily accessible pipe should be examined.
	K. If ten percent or more of the total lot quantity is found to be defective, the Manufacturer is informed that the quality of the pipe is unsatisfactory for acceptance consideration.

Responsibility	Action
Plant Inspector	L. If less than ten percent of the total lot quantity is found to be defective, instructs the Manufacturer to obliterate (blacken out) the NYS DoT Lot Number (NYS DoT...") on those sections the Plant Inspector determines to be unacceptable and advises the Manufacturer to revise the quantity detailed on the certification. This is to be done under the supervision of the Plant Inspector. Proceeds to P.
Manufacturer	M. If further acceptance consideration is desired on lots where ten percent or more of the total quantity is found to be defective, does the following: 1. Culls the lot by evaluating each section. 2. Places the sections, found to be acceptable, in a location providing safe and easy access for the Plant Inspector to evaluate each section. 3. Revises the quantity detailed on the certification.
Plant Inspector	N. Evaluates the culled lot. If the Plant Inspector determines that ten percent or more of the culled material is unacceptable, the lot will be rejected without further Department acceptance consideration.
	O. If after evaluating the culled lot the Plant Inspector determines that less than ten percent of the culled material is unacceptable, he instructs the Manufacturer to obliterate (blacken out) the NYS DoT Lot Number ("NYS DoT...") on each of the unacceptable sections. This is to be done under the supervision of the Plant Inspector.
	P. Determines the tests to be performed in accordance with the following table, "Schedule of Required Tests".

SCHEDULE OF REQUIRED TESTS PER LOT

PIPE ITEM	THREE-EDGE BEARING TEST	ABSORPTION* TEST	AIR CONTENT TEST	INFILTRATION RATE
Non-Reinforced Concrete Pipe	One Minimum	Three cores, a minimum of 2" in diameter, or at the option of the Mfg., Sawed 4" square specimens, one from each of three lengths	Not Required	Not Required
Reinforced Concrete Pipe, Reinforced Concrete Elliptical Pipe	One Minimum	Three cores, a minimum of 3" in diameter, one from each of three lengths	Not Required	Not Required
Porous Concrete Pipe Underdrain, Extra Strength Porous Concrete Pipe Underdrain	One Representing each 500 units or fraction thereof in the lot	Not Required	Not Required	One Unit
Reinforced Concrete Pipe End Sections	Not Required	Not Required	One 4" diameter core	Not Required
Reinforced Concrete Cattle Pass	Not Required	Three cores, a minimum of 3" in diameter, one from each of three lengths	Not Required	Not Required

*Absorption testing will not be required on pipe from those Manufacturers who have received a letter from the Director, Materials Bureau waiving the requirement of that test for acceptance consideration.

Responsibility	Action
Plant Inspector	Q. Randomly selects the sections of pipe to be tested. (If testing is to be performed at a later date, the Plant Inspector shall apply adequate identifiers for later verification.) Note: See Appendix 15 for Random Number Table.

XII. Acceptance Testing - Concrete pipe items are considered for acceptance by the testing of pipe sections or cores drilled from pipe sections. The test to be performed on the individual pipe items are detailed in the tabulation of Section XI, Sampling For Acceptance Consideration of Pipe Items In Stock Lot Quantities.

A. Absorption test - The absorption test will be performed on lots of pipe manufactured by those companies with insufficient Department history of absorption testing performance. The test history will be established, for Manufacturers new to the Department, based upon a minimum of 10 lots of pipe over a period of reasonably continuous production of at least a 6 month duration.

All Manufacturers who have established a satisfactory absorption test history will receive a letter from the Director, Materials Bureau, copied to the Inspection Authority, waiving the required absorption testing until further notice.

Responsibility	Action
Manufacturer, as witnessed by Plant Inspector	1. Drills one core a minimum of 3 inches in diameter from each of three pipe sections.
Plant Inspector	2. Completes Form BR240, Sample and Acceptance Transmittal.
	3. Packages the samples, inserts the completed BR240 enclosed in a BR241 and forwards to the Materials Bureau. Note: If the samples are sent by the Manufacturer, it shall be so noted in box 16 of Form BR240. The sample container shall be sealed by the Plant Inspector with red tape seals. The cost of shipment shall be borne by the Manufacturer.

Responsibility	Action
Materials Bureau	4. Performs the absorption test.
	5. Indicates the average test result for the three cores representing the pipe and a statement as to conformance or non-conformance to the specification on the BR240.
	6. Transmits the yellow, green and white copies of the BR240 to the Inspection Authority.
Inspection Authority	7. Receives BR240 copies. Evaluates the results along with the results of the other required tests and determines Acceptance/Rejection action as detailed in Section XIII.
Manufacturer	8. Repairs the cored sections, to the satisfaction of the Plant Inspector, if they are to be included in the lot quantity.

B. Percent Air Content Test - The percent air content test is performed on Reinforced Concrete Pipe End Sections by the testing of a core to determine percent air content.

Responsibility	Action
Manufacturer, as witnessed by the Plant Inspector	1. Drills one 4 inch diameter core 8 inches long or as dictated by the thickness of concrete.
Plant Inspector	2. Completes Form BR240, Sample and Acceptance Transmittal.
Note: The certification for Reinforced Concrete Pipe End Sections shall contain a statement certifying that concrete used in the manufacture meets or exceeds 3000 PSI @ 28 days	3. Packages the core, inserts the completed BR240 with the Manufacturer's Certification, with the Plant Inspector's initials on the reverse side of that certification indicating review and approval, into the BR241 envelope and forwards to the Materials Bureau. Note: If the samples are sent by the Manufacturer, it shall be so noted in box 16 of Form BR240. The samples shall be sealed by the Plant Inspector with red tape seals. The cost of shipment shall be borne by the Manufacturer.

Responsibility	Action
Materials Bureau	4. Performs the test to determine percent air content.
	5. Indicates Accepted/Rejected action on and validates Form BR240.
	6. Issues yellow and green copies of Form BR240 to the Inspection Authority.
Inspection Authority	7. Receives yellow and green validated copies of Form BR240 marked accepted or rejected from the Materials Bureau.
	8. Notifies the Manufacturer of the Department action.
	9. Retains the yellow copy of the BR240. If the lot is accepted, forwards the green copy to the Manufacturer.

C. Infiltration Test - The infiltration test is performed on Porous Concrete Pipe Underdrain and Extra Strength Porous Concrete Pipe Underdrain.

Responsibility	Action
Manufacturer, as witnessed by the Plant Inspector	1. Performs the infiltration test utilizing the procedure detailed in Appendix 8.
Plant Inspector	2. Reports the results in the required format to the Inspection Authority.
Inspection Authority	3. Evaluates the results along with the results of the other required test and determines acceptance/rejection action as detailed in Section XIII.

D. Three-Edge-Bearing Test

Responsibility	Action
Manufacturer, as witnessed by two Plant Inspectors	1. Performs the three-edge-bearing test utilizing the procedure detailed in Appendix 6.
Plant Inspector	2. Reports the results in the required format to the Inspection Authority.

Responsibility	Action
Inspection Authority	3. Evaluates the results along with the results of the other required tests and determines action as detailed in Section XIII, Acceptance/Rejection Action.

XIII. Acceptance/Rejection Action - All concrete pipe items with the exception of Reinforced Concrete Pipe End Sections (see Section XII, B. Percent Air Content Test) will be evaluated and accepted or rejected by the Inspection Authority.

Responsibility	Action
Plant Inspector	A. Prepares a report detailing the results of the required tests. Note: When absorption testing, to be performed by the Materials Bureau, is required for stock lot acceptance of the pipe (see Section XI, P), a BR240 shall be used to transmit cores representing the pipe. The Materials Bureau will return the results of testing and recommended action for absorption, detailed on the returned copy of the BR240, which will serve as a report for that test. The Plant Inspector shall prepare a second BR240 as detailed below to document the acceptance/rejection action of the pipe. B. Completes a Form BR240 in accordance with the examples shown in Appendix No. 12. C. Assigns a test number to be recorded in the upper right corner of the form. The test number shall be preceded by the last two digits of the calendar year followed by a unique three letter identifier for each plant. This unique identifier will be issued by the Materials Bureau. The test number will be consecutive numbers issued by the Inspection Authority starting with one at the beginning of each calendar year and progressing consecutively throughout the year.

Responsibility	Action
Plant Inspector	D. Submits the report, BR240 and Manufacturer's Certification to the Inspection Authority.
Inspection Authority	E. Reviews, determines all required tests have been completed, evaluates the test results and Manufacturer's Certification.
	F. Takes the appropriate acceptance/ rejection action by completing the top portion of the BR240 as follows: Material represented by the sample described below was: Accepted or Rejected On: (date of final action) For: Item number, Item name, Class and diameter of pipe. Note: Examples of properly completed BR240's are contained in Appendix 12.
	G. The BR240 is signed by an authorized representative of the Inspection Authority in the lower right hand corner entitled, "Materials Bureau Validation". Note: The BR240 is a general purpose form to handle acceptance/rejection action on materials tested and acted upon by the Materials Bureau. The BR240's use is herein modified to move the Department acceptance/rejection action to the Inspection Authority.
	H. Detaches the buff (card) copy of the BR240 and attaches it to the test report and certifications to be retained in the Inspection Authority records.
	I. Distributes the remaining completed copies of the BR240 form as follows: 1. Yellow copy, transmit to the Materials Bureau. 2. Green copy, transmit to the Manufacturer. 3. White copy, retained.

Responsibility	Action
Inspection Authority	J. Maintains accurate and complete record of the lots tested, action taken and test results for all pipe items considered for acceptance.
Manufacturer	K. Attaches the green copy of the validated BR240 to the BR259, Record of Shipment for that lot as required in Section XIV.
Materials Bureau	L. Maintains a record of pipe item lots accepted at the various manufacturing locations producing for Department projects.

XIV. Shipment and Evaluation of Pipe at the Project Site

Responsibility	Action
Manufacturer	A. Prepares a Form BR259, Record of Shipment for each lot of pipe items accepted by the Department and attaches the green copy of the BR240 noted with the word "Accepted".
	B. Prepares the pipe for shipment by removing and obliterating the NYS DoT Lot Number on all sections that were damaged since stockpiling. The criteria for evaluating the pipe is contained in Appendix 9.
	C. Prepares Form BR97, Shipment Certification (an example of a properly completed Form BR97 is detailed in Appendix 13) for each individual vehicle and distributes as follows: 1. White copy accompanies the pipe item to the project site 2. Yellow and Pink copy to the Inspection Authority 3. Gold copy is retained by the Manufacturer Note: A BR97 is prepared by the Manufacturer for <u>all</u> shipments of pipe items from Department lots, to verify the inventory regardless as to Department projects, non-Department projects or transfer shipments. For shipments to non-Department projects, the white copy of the BR97 is destroyed and does not accompany the shipment.

Responsibility	Action
Manufacturer	D. Enters information for each shipment on Form BR259, Record of Shipment. All shipments must be entered, including transfer shipments and shipments to non-Department projects. Note: Occasional shipments of Department accepted pipe items to non-Department work may be tolerated upon approval of the Director, Materials Bureau.
Project Inspector	E. Receives the shipment and the white copy of Form BR97.
	F. Verifies that each section of pipe received has not been damaged. The criteria for evaluating the pipe is contained in Appendix 9. Note: It is important that each length of pipe item is evaluated. Due to safety concerns, the Plant Inspector is not always able to evaluate all pieces stacked in the stockpile. Pipe items are also occasionally damaged during shipment which can make individual sections unacceptable.
	G. Verify the identification on each section agrees with the information of Form BR97 and the requirements of the specification (refer to section 2A of MURK, Materials Inspection Manual).
	H. Verify the quantity agrees with information on Form BR97.
Inspection Authority	I. Receives yellow and pink copy of BR97, verifies the information detailed is correct. If incorrect, returns them to the Manufacturer for correction.
	J. When the BR97 is determined to be acceptable, it is signed by an authorized representative of the Inspection Authority in the box entitled "Shipment Validation".

Responsibility	Action
Inspection Authority	K. Forwards the yellow copy of BR97 to the Regional Office having jurisdiction over the project receiving the shipment, for payment authorization.
Regional Office	L. Forwards the validated Form BR97 to the project site.
Project Inspector	M. Verifies that the validated yellow BR97 is a copy of the one received with the shipment.
	N. Retains the validated BR97 to provide Evidence of Acceptability for payment of the pipe item.

XV. Inventory Control - The Manufacturer is required to maintain records detailing the quantity and shipments of all pipe items manufactured and identified with a NYS DoT lot number. The BR259, Record of Shipments and BR97, Shipment Certification shall be completed as detailed in Section XIV, Shipment and Evaluation of Pipe at the Project Site.

Responsibility	Action
Manufacturer	A. Provides the Plant Inspector, as requested, complete and organized documents detailing the destinations of shipments and inventory in stock of all active lots and any inactive lots he may desire to evaluate. Note: Records are not required to be retained by the Manufacturer three years subsequent to the date that all sections of pipe in the lot are shipped and accounted for.
Inspection Authority	B. Assigns a Plant Inspector to evaluate the Manufacturer's records and compare them to the yard inventory. This shall be performed at a frequency determined by the Inspection Authority who is responsible to assure accurate record keeping. It is recommended that a complete inventory be performed on an annual basis, with spot verifications throughout the year.

Responsibility	Action
Plant Inspector	C. Compares the Manufacturer's records to those of the Inspection Authority and the remaining inventory.
	D. Prepares a report for each of the lots inventoried detailing the following: 1. Lot Number 2. Item Number 3. Manufacturer 4. Size 5. Quantity Accepted 6. Quantity Shipped to DoT Projects (identified by contract number(s)) 7. Quantity shipped to non-DoT projects 8. Quantity transferred and shipped to other locations 9. Quantity rejected by the Manufacturer 10. Quantity rejected by project staff and returned to Manufacturer 11. Disposition of units returned to the Manufacturer 12. Quantity in inventory 13. Note any discrepancies in quantities
	E. Submits report to the Inspection Authority.
Inspection Authority	F. Reviews the Plant Inspector's report and notifies the Manufacturer of the results of the inventory.
	G. Requires the Manufacturer to take corrective action, if necessary. The Inspection Authority, at their discretion, may require the Manufacturer to document the corrective action. That documentation shall be addressed to the Inspection Authority and copied to the Director, Materials Bureau.

Responsibility	Action
Inspection Authority and Materials Bureau	H. Closely evaluates all deficiencies and the corrective action.
	I. Determines if the Manufacturer can maintain adequate records to supply pipe items to Department projects.
	Note: The Manufacturer's ability to maintain proper record keeping is of extreme importance. If the proper records cannot be maintained to establish inventory control, the Materials Bureau will evaluate the Manufacturer's ability to certify the pipe items manufactured and the maintenance of records for the approved materials used in production.
	J. Notifies the Manufacturer of Department Action.

XVI. Acceptance of Pipe from Commercial Inventory - Written requests for the consideration of pipe from commercial inventory shall be directed to the Director, Materials Bureau. The request shall contain the Manufacturer's Certification for the pipe, the Department contract number and quantity requested to be considered.

The Materials Bureau will review the request with the Inspection Authority and, if consideration is given, detail the required inspection and testing to be performed.

Appendix No. 1

Class II - Reinforced Concrete Pipe
Three-Edge-Bearing Test Loads
(Lbs./Linear Foot)

Item 603.74

Pipe Diameter (Inches)	0.01 Inch Crack Load	115% of the 0.01 Inch Crack Load	Ultimate Strength
12	1,000	1,150	1,500
15	1,250	1,438	1,875
18	1,500	1,725	2,250
21	1,750	2,012	2,625
24	2,000	2,300	3,000
27	2,250	2,588	3,375
30	2,500	2,875	3,750
33	2,750	3,162	4,125
36	3,000	3,450	4,500
42	3,500	4,025	5,250
48	4,000	4,600	6,000
54	4,500	5,175	6,750
60	5,000	5,750	7,500
66	5,500	6,325	8,250
72	6,000	6,900	9,000
78	6,500	7,475	9,750
84	7,000	8,050	10,500
90	7,500	8,625	11,250
96	8,000	9,200	12,000
102	8,500	9,775	12,750
108	9,000	10,350	13,500

Class III - Reinforced Concrete Pipe
Three-Edge-Bearing Test Loads
(Lbs./Linear Foot)

Item 603.60

Pipe Diameter (Inches)	0.01 Inch Crack Load	115% of the 0.01 Inch Crack Load	Ultimate Strength
12	1,350	1,552	2,000
15	1,687	1,941	2,500
18	2,025	2,329	3,000
21	2,362	2,717	3,500
24	2,700	3,105	4,000
27	3,038	3,493	4,500
30	3,375	3,881	5,000
33	3,712	4,269	5,500
36	4,050	4,658	6,000
42	4,725	5,434	7,000
48	5,400	6,210	8,000
54	6,075	6,986	9,000
60	6,750	7,762	10,000
66	7,425	8,539	11,000
72	8,100	9,315	12,000
78	8,775	10,091	13,000
84	9,450	10,868	14,000
90	10,125	11,644	15,000
96	10,800	12,420	16,000
102	11,475	13,196	17,000
108	12,150	13,972	18,000
114	12,825	14,749	19,000

Class III - Reinforced Concrete Pipe
Three-Edge-Bearing Test Loads
(Lbs./Linear Foot)

Item 603.60

Pipe Diameter (Inches)	0.01 Inch Crack Load	115% of the 0.01 Inch Crack Load	Ultimate Strength
120	13,500	15,525	20,000
126	14,175	16,301	21,000
132	14,850	17,078	22,000
138	15,525	17,854	23,000
144	16,200	18,630	24,000

Class IV - Reinforced Concrete Pipe
Three-Edge-Bearing Test Loads
(Lbs./Linear Foot)

Item 603.61

Pipe Diameter (Inches)	0.01 Inch Crack Load	115% of the 0.01 Inch Crack Load	Ultimate Strength
12	2,000	2,300	3,000
15	2,500	2,875	3,750
18	3,000	3,450	4,500
21	3,500	4,025	5,250
24	4,000	4,600	6,000
27	4,500	5,175	6,750
30	5,000	5,750	7,500
33	5,500	6,325	8,250
36	6,000	6,900	9,000
42	7,000	8,050	10,500
48	8,000	9,200	12,000
54	9,000	10,350	13,500
60	10,000	11,500	15,000
66	11,000	12,650	16,500
72	12,000	13,800	18,000
78	13,000	14,950	19,500
84	14,000	16,100	21,000
90	15,000	17,250	22,500
96	16,000	18,400	24,000
102	17,000	19,550	25,500
108	18,000	20,700	27,000
114	19,000	21,850	28,500
120	20,000	23,000	30,000

Class IV - Reinforced Concrete Pipe
Three-Edge-Bearing Test Loads
(Lbs./Linear Foot)

Item 603.61

Pipe Diameter (Inches)	0.01 Inch Crack Load	115% of the 0.01 Inch Crack Load	Ultimate Strength
126	21,000	24,150	31,500
132	22,000	25,300	33,000
138	23,000	26,450	34,500
144	24,000	27,600	36,000

Class V - Reinforced Concrete Pipe
Three-Edge-Bearing Test Loads
(Lbs./Linear Foot)

Item 603.62

Pipe Diameter (Inches)	0.01 Inch Crack Load	115% of the 0.01 Inch Crack Load	Ultimate Strength
12	3,000	3,450	3,750
15	3,750	4,312	4,688
18	4,500	5,175	5,625
21	5,250	6,038	6,562
24	6,000	6,900	7,500
27	6,750	7,762	8,438
30	7,500	8,625	9,375
33	8,250	9,488	10,312
36	9,000	10,350	11,250
42	10,500	12,075	13,125
48	12,000	13,800	15,000
54	13,500	15,525	16,875
60	15,000	17,250	18,750
66	16,500	18,975	20,625
72	18,000	20,700	22,500
78	19,500	22,425	24,375
84	21,000	24,150	26,250
90	22,500	25,875	28,125
96	24,000	27,600	30,000
102	25,500	29,325	31,875
108	27,000	31,050	33,750
114	28,500	32,775	35,625
120	30,000	34,500	37,500

Class V - Reinforced Concrete Pipe
Three-Edge-Bearing Test Loads
(Lbs./Linear Foot)

Item 603.62

Pipe Diameter (Inches)	0.01 Inch Crack Load	115% of the 0.01 Inch Crack Load	Ultimate Strength
126	31,500	36,225	39,375
132	33,000	37,950	41,250
138	34,500	39,675	43,125
144	36,000	41,400	45,000

Appendix No. 2

Class HE II - Horizontal Elliptical Reinforced Concrete Pipe
Three-Edge-Bearing Test Loads
(Lbs./Linear Foot)

Item 603.66

Equiv. Round Diameter (Inches)	0.01 Inch Crack Load	115% of the 0.01 Inch Crack Load	Ultimate Strength
24"	2,500	2,875	3,750
27"	2,833	3,258	4,250
30"	3,167	3,642	4,750
33"	3,500	4,025	5,250
36"	3,750	4,312	5,625
39"	4,083	4,696	6,125
42"	4,417	5,079	6,625
48"	5,000	5,750	7,500
54"	5,667	6,517	8,500
60"	6,333	7,283	9,500
66"	6,917	7,954	10,375
72"	7,583	8,721	11,375
78"	8,167	9,392	12,250
84"	8,833	10,158	13,250
90"	9,417	10,829	14,125
96"	10,083	11,596	15,125
102"	10,667	12,267	16,000
108"	11,333	13,033	17,000

Class HE III - Horizontal Elliptical Reinforced Concrete Pipe
Three-Edge-Bearing Test Loads
(Lbs./Linear Foot)

Item 603.67

Equiv. Round Diameter (Inches)	0.01 Inch Crack Load	115% of the 0.01 Inch Crack Load	Ultimate Strength
24"	3,375	3,881	5,000
27"	3,825	4,399	5,667
30"	4,275	4,916	6,333
33"	4,725	5,434	7,000
36"	5,062	5,822	7,500
39"	5,512	6,339	8,167
42"	5,962	6,857	8,833
48"	6,750	7,762	10,000
54"	7,650	8,797	11,333
60"	8,550	9,832	12,667
66"	9,337	10,738	13,833
72"	10,237	11,773	15,167
78"	11,025	12,679	16,333
84"	11,925	13,714	17,667
90"	12,712	14,619	18,833
96"	13,612	15,654	20,167
102"	14,400	16,560	21,333
108"	15,300	17,595	22,667

Class HE IV - Horizontal Elliptical Reinforced Concrete Pipe
Three-Edge-Bearing Test Loads
(Lbs./Linear Foot)

Item 603.68

Equiv. Round Diameter (Inches)	0.01 Inch Crack Load	115% of the 0.01 Inch Crack Load	Ultimate Strength
24"	5,000	5,750	7,500
27"	5,667	6,517	8,500
30"	6,333	7,283	9,500
33"	7,000	8,050	10,500
36"	7,500	8,625	11,250
39"	8,167	9,392	12,250
42"	8,833	10,158	13,250
48"	10,000	11,500	15,000
54"	11,333	13,033	17,000
60"	12,667	14,567	19,000
66"	13,833	15,908	20,750
72"	15,167	17,442	22,750
78"	16,333	18,783	24,500
84"	17,667	20,317	26,500
90"	18,833	21,658	28,250
96"	20,167	23,192	30,250
102"	21,333	24,533	32,000
108"	22,667	26,067	34,000

Appendix No. 3

Class VE IV - Vertical Elliptical Reinforced Concrete Pipe
Three-Edge-Bearing Test Loads
(Lbs./Linear Foot)

Item 603.69

Equiv. Round Diameter (Inches)	0.01 Inch Crack Load	115% of the 0.01 Inch Crack Load	Ultimate Strength
36"	4,833	5,558	7,250
39"	5,333	6,133	8,000
42"	5,667	6,517	8,500
48"	6,333	7,283	9,500
54"	7,167	8,242	10,750
60"	8,000	9,200	12,000
66"	8,833	10,158	13,250
72"	9,667	11,117	14,500
78"	10,500	12,075	15,750
84"	11,333	13,033	17,000
90"	12,000	13,800	18,000
96"	12,833	14,758	19,250
102"	13,667	15,717	20,500
108"	14,500	16,675	21,750

Class VE V - Vertical Elliptical Reinforced Concrete Pipe
Three-Edge-Bearing Test Loads
(Lbs./Linear Foot)

Item 603.71

Equiv. Round Diameter (Inches)	0.01 Inch Crack Load	115% of the 0.01 Inch Crack Load	Ultimate Strength
36"	7,250	8,337	9,062
39"	8,000	9,200	10,000
42"	8,500	9,775	10,625
48"	9,500	10,925	11,875
54"	10,750	12,362	13,437
60"	12,000	13,800	15,000
66"	13,250	15,237	16,562
72"	14,500	16,675	18,125
78"	15,750	18,112	19,688
84"	17,000	19,550	21,250
90"	18,000	20,700	22,500
96"	19,250	22,137	24,062
102"	20,500	23,575	25,625
108"	21,750	25,012	27,188

Class VE VI - Vertical Elliptical Reinforced Concrete Pipe
Three-Edge-Bearing Test Loads
(Lbs./Linear Foot)

Item 603.71

Equiv. Round Diameter (Inches)	0.01 Inch Crack Load	115% of the 0.01 Inch Crack Load	Ultimate Strength
36"	9,667	11,117	12,083
39"	10,667	12,267	13,333
42"	11,333	13,033	14,167
48"	12,667	14,567	15,833
54"	14,333	16,483	17,917
60"	16,000	18,400	20,000
66"	17,667	20,317	22,083
72"	19,333	22,233	24,167
78"	21,000	24,150	26,250
84"	22,667	26,067	28,333
90"	24,000	27,600	30,000
96"	25,667	29,517	32,083
102"	27,333	31,433	34,167
108"	29,000	33,350	36,250

Appendix No. 4

Non-Reinforced Concrete Pipe
Three-Edge-Bearing Test Loads
(Lbs./Lf.)

Item 603.02

Internal Diameter (Inches)	Ultimate Strength
4	1500
6	1500
8	1500
10	1600
12	2250
15	2600
18	3000
21	3300
24	3600

Appendix No. 5

706-05, Porous Concrete Pipe Underdrain
Three-Edge-Bearing Test and Infiltration Test Requirements

Item 605.04

Internal Diameter (Inches)	Ultimate Three-Edge -Bearing Strength (Lbs/Lf)	Minimum Infiltration Rate (Gal/Min. ft)
4	1000	4
6	1100	6
8	1300	8
10	1400	10
12	1500	12

706-06, Extra Strength Porous Concrete Pipe Underdrain
Three-Edge-Bearing Test and Infiltration Test Requirements

Item 605.05

Internal Diameter (Inches)	Ultimate Three-Edge -Bearing Strength (Lbs/Lf)	Minimum Infiltration Rate (Gal/Min. ft)
6	2200	6
8	2600	8
10	2800	10
12	3000	12
15	3750	15
18	3750	18

Appendix No. 6

Test Method
Three-Edge-Bearing Test

SCOPE

This test method outlines the apparatus and procedure to be utilized in performing the Three-Edge-Bearing Test for Concrete Pipe Items intended for Department proof of design and/or acceptance consideration. It is based upon the requirements specified in ASTM C497.

APPARATUS

1. Testing Machine - A machine designed to apply a crushing force upon the concrete pipe specimen in a plane through the vertical axis extending along the length of the pipe.

   NOTE: The specific requirements of the testing machine detailed below are listed as a reference for the Plant Inspector. This does not relieve the Manufacturer from the remainder of the requirements of ASTM C497.

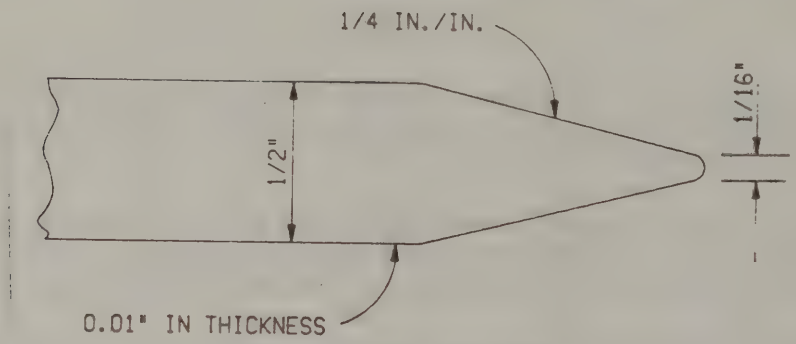
   a. The concrete pipe specimen shall be supported on two parallel longitudinal strips and load applied through a top bearing beam. At the option of the Manufacturer, the two parallel strips or the top bearing beam may extend the full length or any portion of the length of the specimen.

   b. The lower bearings shall consist of hardwood or hard rubber strips. The strips (hardwood or hard rubber) shall be straight, have a cross section of not less than 2 inches in width and between 1 to 1½ inches in height. The top inside corners of the strips shall be rounded to a radius of ½ inch. Hard rubber strips shall have durometer hardness of not less than 45 nor more than 60.

   c. The upper bearing shall be a rigid hardwood beam with or without an attached hard rubber strip. The wood block shall be sound, free of knots, and straight and true from end to end. The bearing face of the top bearing block shall not deviate from a straight line by more than 1/32 inch per foot of length. When a hard rubber strip is used on the bearing face it shall have a durometer hardness of not less than 45 nor more than 60 and shall have a width of not less than 2 inches and a thickness of not less than 1 inch nor more than 1½ inches and shall be secured to a wood block meeting the above requirements.

   d. The machine shall contain a device to record the load applied to the test specimen. The recording device shall be an integral part of the testing machine and provide an accuracy of ± 2% at the specified test loads. The test machine shall be calibrated in accordance with ASTM E4 at a minimum of once a year.

2. Crack Gage - A gage made from metal leaf 0.01 inch in thickness, ground to a point 1/16 inch in width with rounded corners and with a taper of ¼ inch per inch. (See diagram below.)



Gage Leaf for Measuring Cracks

PROCEDURE

The Department requires two Department representatives to be present to witness the test as performed by the Manufacturer. One Plant Inspector is required to observe the testing machine loading dial and verbally call out the increments of applied load. The second Plant Inspector visually inspects the interior of the pipe barrel for the development of the 0.01" Crack during the loading while listening to the applied load being called out by his Co-inspector.

NOTE: The 0.01 inch crack is defined as a crack having a width of 0.01 inch and occurs throughout a continuous length of 1 foot or more measured parallel to the longitudinal axis of pipe barrel. Consider the crack 0.01 inch in width when the point of the measuring gage will without forcing, penetrate 1/16 inch at close intervals, throughout the specified distance of 1 foot.

1. Verify that the test specimens,

   1. Have not been exposed to a temperature below 40°F for the 24 hour period immediately preceding the test.
   2. Are free of visible moisture.

2. Shall determine the diameter and class of pipe to be tested and utilizing the appropriate table in Appendices 1-5 of this Materials Method, calculate the following loads:

   a. The 0.01 inch Crack Load by multiplying the length of the pipe section in feet by the 0.01 inch crack load found in the appropriate appendices for that type and class pipe.

      e.g. for 12 inch diameter Class IV pipe, 8.0 feet long.

      The 0.01 inch crack load found in Appendix 1, Class IV - Reinforced Concrete Pipe Three-Edge-Bearing Test Loads for 12" diameter equals 2000 lbs/linear foot.

      8.0 lf x 2000 lbs/lf = 16,000 lbs.

   b. 115% of the 0.01 Inch Crack Load by multiplying the length of the pipe section in feet by the 115% of the 0.01 inch crack load found in the appropriate appendices for that type and class pipe.

      e.g. For 12" diameter - Class IV pipe, 8.0 feet long.

      The 115% of the 0.01 inch crack load found in Appendix 1, Class IV - Reinforced Concrete Pipe Three-Edge-Bearing Test Loads for 12" diameter equals 2,300 lbs/linear foot.

      8.0 lf x 2300 lbs/lf = 18,400 lbs.

   c. The Ultimate Strength by multiplying the length of the pipe section in feet by the ultimate strength found in the appropriate appendices for that type and class pipe.

      e.g. For 12" diameter - Class IV pipe units, 8.0 feet long

      The Ultimate Strength found in Appendix 1, Class IV - Reinforced Concrete Pipe Three-Edge-Bearing Test Loads for 12" diameter equals 3000 lbs/linear foot.

      8.0 lf x 3000 lbs./lf. = 24,000 lbs.

      A pipe section shall be considered destroyed when the pipe section will exhibit deflection but no increase in load while under test.

3. As a result the inspector will have available for reference at the time of the test the Three-Edge Loads to be anticipated:

   e.g. For 12" diameter-Class IV pipe units 8.0 lf long.
   0.01 inch Crack Load = 16,000 lbs.
   115% of the 0.01 inch Crack Load = 18,400 lbs.
   Ultimate Strength = 24,000 lbs.

4. The loads thus calculated must be modified by the testing machine's loading dial characteristics. The Inspector must determine if the load indicator registers GROSS LOAD (hydraulically applied load + weight of top beam) or NET LOAD (hydraulically applied load only). If the indicator registers NET LOAD, the inspector must add on the weight of the top beam to the NET LOAD indicated to arrive at the true applied load.

   e.g. For 12" diameter-Class IV pipe units, the dial readings to be anticipated are:

   a. On a testing machine registering Gross Load:

      0.01 Inch Crack Load = 16,000 lbs.
      115% of the 0.01 Inch Crack Load = 18,400 lbs.
      Ultimate Strength = 24,000 lbs.

   b. On a testing machine registering Net Load which has a top beam weight of 2,000 lbs. (this weight should be recorded on the calibration report), the dial readings to be anticipated are:

      0.01 Inch Crack Load = 14,000 lbs.
      115% of the 0.01 Inch Crack Load = 16,400 lbs.
      Ultimate Load = 22,000 lbs.

5. The Inspector shall witness the test procedure as carried out by the Manufacturer and verify that the following specification requirements have been met.

   a. The test specimen shall be placed on the lower bearing strips in such a way that the most uniform bearing possible occurs on both strips.

   b. The test specimen shall be marked at both ends at a point midway between the lower bearing strips. The point diametrically opposite that point at each end of the unit shall also be marked.

   c. The top bearing beam shall be placed upon the specimen so that it is properly aligned with both of these marks on the top of the pipe unit.

d. Once the pipe unit has been properly placed on the testing machine, the load shall be applied at the following rates:

1. For reinforced concrete pipe any rate of load application up to a maximum of 7500 lb/lf of pipe per minute up to 75% of the 0.01 inch crack load at which time the loading rate shall be reduced to 3000 lb/lf of pipe per minute until 115% of the 0.01 inch crack strength is achieved. If the ultimate strength is being determined, a specified loading rate need not be maintained after achieving the 115% of the 0.01 inch crack strength.

   e.g. A standard 8.0 foot length of pipe 12" diameter - Class IV pipe with the following specified loads shall be loaded at the following rates.

   0.01 inch crack load = 16,000 lbs
   115% of the 0.01 inch
   Crack Load = 18,400 lbs
   Ultimate Strength = 24,000 lbs

   75% of the 0.01" Crack Load equals 12,000 lbs. Therefore the pipe may be loaded from 0 to 12,000 lbs at a rate of 7500 lbs/ft (60,000 lbs) per minute. Therefore in this example it shall take at least 12 seconds to obtain a load of 12,000 lbs. From 12,000 lbs to 18,400 lbs the rate of loading shall be reduced to 3000 lb/lf (24,000 lbs) per minute. Therefore in this example it shall take at least 16 seconds to load from 12,000 lbs to 18,400 lbs, a total of 6400 lbs. When 18,400 lbs is surpassed the rate of loading is not specified.

2. For non-reinforced concrete pipe any rate of loading up to a maximum of 7500 lb/lf of pipe per minute may be used up to 75% of the ultimate strength at which time the rate of loading shall be reduced to a maximum uniform rate of 3000 lb/lf of pipe per minute.

   e.g. A 4.0 foot length of 12 inch diameter non-reinforced concrete pipe with the following specified load as detailed in Appendix No. 4.

   12 inch internal diameter 2250 lb/lf Ultimate Strength
   2250 lb/lf x 4 lf = 9000 lbs

   75% of the ultimate strength equals 6750, therefore the pipe may be loaded from 0 to 6750 lbs at a rate of 7500 lbs/lf (30,000 lbs) per minute. Therefore in this example it shall take at least 14 seconds to achieve 6750 lbs. From 6750 lbs to 9000 lbs the rate must be reduced to a maximum of 3000 lbs/lf (12,000 lbs) per minute. Therefore in this example it shall take at least 11 seconds to load from 6750 lbs to the ultimate strength.

Note: In order for a recorded load to be considered valid, it must be between 10% and 100% of that total dial capacity. e.g. If the dial capacity is 250,000 lbs. and the 0.01" crack load developes at 20,000 lbs. as indicated on the scale, that reading may be inaccurate and will be considered invalid. The pipe will have to be tested on a machine with a lower dial capacity.

6. As the load is applied uniformly at the rate prescribed above, one Inspector calls out the increments of load applied as the second Inspector, in possession of his 0.01 Inch Crack Gauge, observes for the development of any cracks within the barrel of the test unit and measures the width and length of any cracks that do develop.

   Note: The 0.01 inch crack strength is defined as a crack having a width of 0.01 inch and occurs throughout a continuous length of 1 foot or more measured parallel to the longitudinal axis of pipe barrel. Consider the crack 0.01 inch in width when the point of the measuring gage will without forcing, penetrate 1/16 inch at close intervals, throughout the specified distance of 1 foot.

7. If a crack greater than 0.01 inches develops before the 0.01 Inch Crack Strength is reached, the test shall be stopped and the inspector shall select two additional specimens to be tested. The initial specimen tested fails the test, is rejected, and the NYS DoT Lot No. is obliterated by the Manufacturer as witnessed by the Plant Inspector. The two additional specimens both shall be tested for the 0.01 Inch Crack Strength and the Ultimate Strength. For the lot to pass the test, both specimens must meet the specification requirements for the 0.01 Inch Crack Strength and the Ultimate Strength. If either unit tested fails to meet either strength requirement, the lot shall be rejected.

8. If the test specimen meets the 0.01 Inch Crack Strength, the load continues to be uniformly applied while the specimen is observed for the development of any cracks 0.01 inches or greater.

9. If the test specimen meets 115% of the 0.01 Inch Crack Strength without the development of such a crack, the unit passes the Three-Edge-Bearing Test and the testing of the specimen may be stopped. This specimen itself may be returned to the stockpile and shipped to Department project sites.

10. If the test specimen does develop such a crack before 115% of the 0.01 Inch Crack Strength is reached, the loading of the pipe unit under test must be continued until either the pipe unit is destroyed or the unit meets the Ultimate Strength requirement.

11. In summary, the Three-Edge-Bearing Test utilized by the Department may be viewed as a three-part test i.e. tests for the 0.01 Inch Crack Strength, 115% of the 0.01 Inch Crack Strength, and the Ultimate Strength. A lot of pipe tested under this system may pass the Three-Edge-Bearing Test in only three ways.

a. The one unit tested representing the lot may meet both the 0.01 Inch Crack Strength and 115% of the 0.01 Inch Crack Strength on the first attempt or ...
b. The one unit tested may meet the 0.01 Inch Crack Strength, fail to meet 115% of the 0.01 Inch Crack Strength, but meet the Ultimate Strength or ...
c. The first unit tested may fail to meet the 0.01 Inch Crack Strength. In this case two additional units are tested for both the 0.01 Inch Crack Strength and the Ultimate Strength. For the lot to pass the Three-Edge-Bearing Test, each of the additional units tested must meet both of these Strength Tests.

12. The Inspector should record the results of this testing in a manner similar to that below which documents the significant observations made during the test.

e.g. For 12" Class IV pipe that met both the 0.01 Inch Crack Strength and 115% of this value, the results should be recorded as follows:

No 0.01 Inch Crack at 2000 lbs./lf.
No 0.01 Inch Crack at 2300 lbs./lf.
Unit passes test. Lot passes test.

e.g. For 12" Class IV pipe that meets the 0.01 Inch Crack Strength, develops a 0.01 Inch Crack before 115% of this value, but meets the Ultimate Strength requirements, the results should be recorded as follows:

No. 0.01 Inch Crack at 2000 lbs./lf.
0.01 Inch Crack at 2150 lbs./lf.
Pipe destroyed at 3200 lbs./lf.
Unit passes test. Lot passes test.

e.g. For 12" Class IV pipe whose first unit fails to meet the 0.01 Inch Crack Strength, but whose two additional units when tested for both the 0.01 Inch Crack Strength and Ultimate Strength, both meet specification requirements, the results should be recorded as follows:

Unit #1
0.01 Inch Crack at 1600 lbs./lf.
Unit fails test. Selected two additional units from lot.

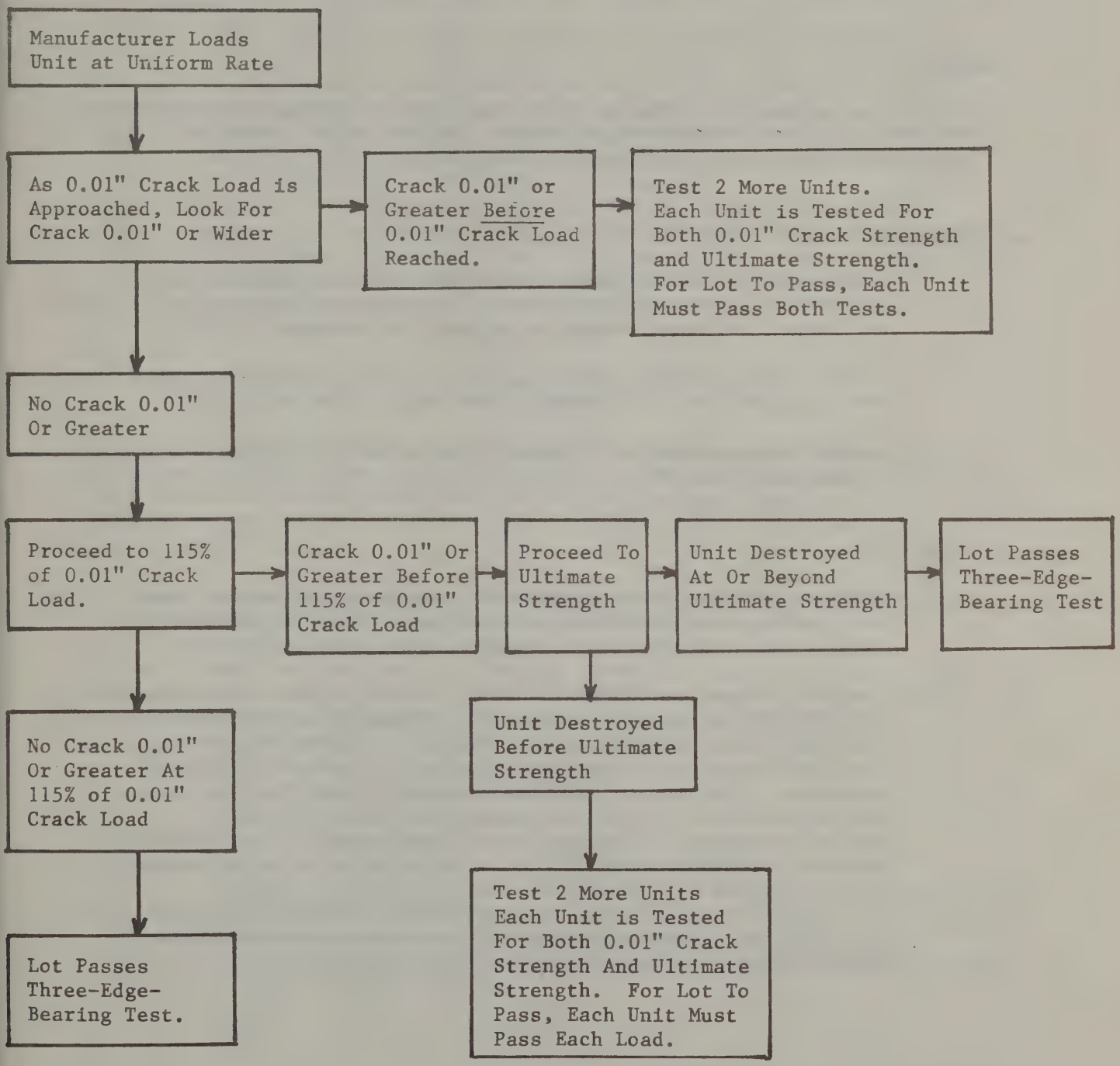
Unit #2
No 0.01 Inch Crack at 2000 lbs./lf.
Pipe destroyed at 3150 lbs./lf.
Unit passes test.

Unit #3
No. 0.01 Inch Crack at 2000 lbs./lf.
Pipe destroyed at 3300 lbs./lf.
Unit passes test.

Lot passes test.

APPENDIX NO. 7

Flow Chart For Three-Edge-Bearing Test



Appendix No. 8

TEST METHOD

Infiltration Rate Test for Porous Concrete Pipe Items.

SCOPE

This method covers the procedure to be used in determining the Infiltration Rate for Porous and Extra-Strength Porous Concrete Pipe Underdrain. It is adapted from the method described in AASHTO M176.

APPARATUS

1. A container of known volume and sufficient size suitable for collecting a known volume of water to assist in determining the rate of flow of the water source to be used in the test.

2. A soft, non-permeable rubber mat and a clamp suitable to anchor the test specimen to the mat during the test.

3. A water source capable of supplying a stream of water at a uniform, stable rate of flow.

PROCEDURE

1. The pipe section to be tested shall be placed spigot end down on a soft, non-permeable rubber mat and clamped down if necessary to prevent the escape of water from the spigot end of the pipe.

2. The Manufacturer as witnessed by the Inspector shall determine the RATE OF FLOW of water in gallons per minute to be introduced into the unit under test by filling the container of known volume with water from the source and determining how long it takes to fill the container. The Rate of Flow is obtained by dividing the volume of the container by the time in minutes it takes to fill it.
   Note: This rate of flow must be at least equal to the required minimum infiltration for 1.0 ft. of pipe as detailed in Appendix 5.

3. A stream of water shall be introduced into the unit under test and the distance above the bottom of the porous section at which the water level becomes constant shall be determined.

CALCULATIONS

The rate of infiltration is calculated as follows:

$$GPM = g/h$$

Where:

GPM = infiltration rate in gallons per minute per foot of pipe
g = gallons per minute of flow introduced into the test pipe and
h = height in feet from the bottom of the porous section of the pipe at which the level of water becomes constant

e.g. Assume that the pipe under test is Item 706-06, Extra Strength Porous Concrete Pipe Underdrain, 10" diameter.

If as a result of the test, the height above the porous section at which the water level becomes constant (h) is 18 inches (1.5 ft) and the Rate of Flow (g) is 18.0 gal/min, the calculation is as follows:

$$\text{Infiltration Rate} = g/h = \frac{18.0 \text{ gal/min}}{1.5 \text{ ft}}$$

$$\text{Infiltration Rate} = 12.0 \text{ GPM/ft}$$

Since the Minimum Infiltration Rate required as detailed in Appendix No. 5 for Item 706-06, Extra Strength Porous Concrete Pipe Underdrain 10" diameter, is 10 GPM and the Infiltration Rate of the specimen is 12.0 gal/min-ft, the sample is considered to have met the Infiltration Rate portion of the specification.

e.g. Assume that the sample under test is Item 706-06, Extra-Strength Porous Concrete Pipe Underdrain, 18" diameter.

If as a result of the test, the height above the porous section at which the water level becomes constant (h) is 24" (2.0 ft.) and the Rate of Flow (g) is determined to be 32.0 gal/min, the calculation is as follows:

$$\text{Infiltration rate} = g/h = \frac{32.0 \text{ gal/min}}{2.0 \text{ ft.}}$$

$$\text{Infiltration rate} = 16.0 \text{ GPM}$$

Since the Minimum Infiltration Rate required by as detailed in Appendix No. 5 for Item 706-06, Extra Strength Porous Concrete Pipe Underdrain 18" diameter, is 18.0 GPM and the results of the testing on the sample indicate an Infiltration Rate of 16.0 GPM, the specimen does not meet the specification requirement for Infiltration Rate.

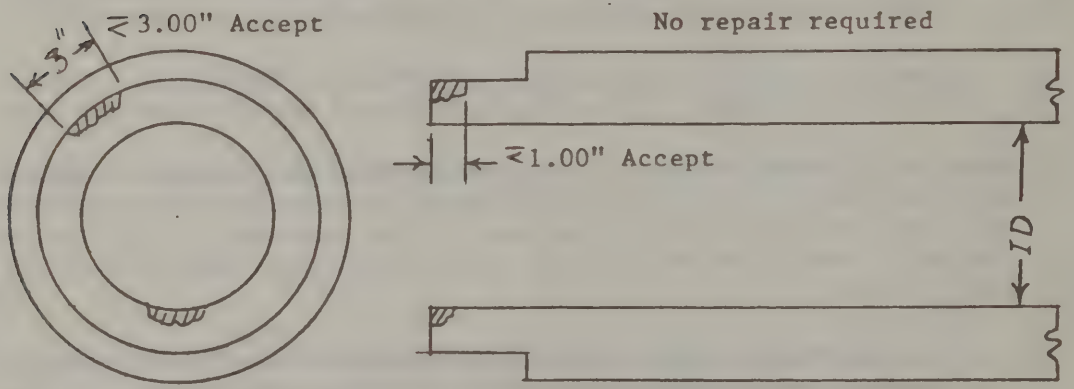
Appendix 9

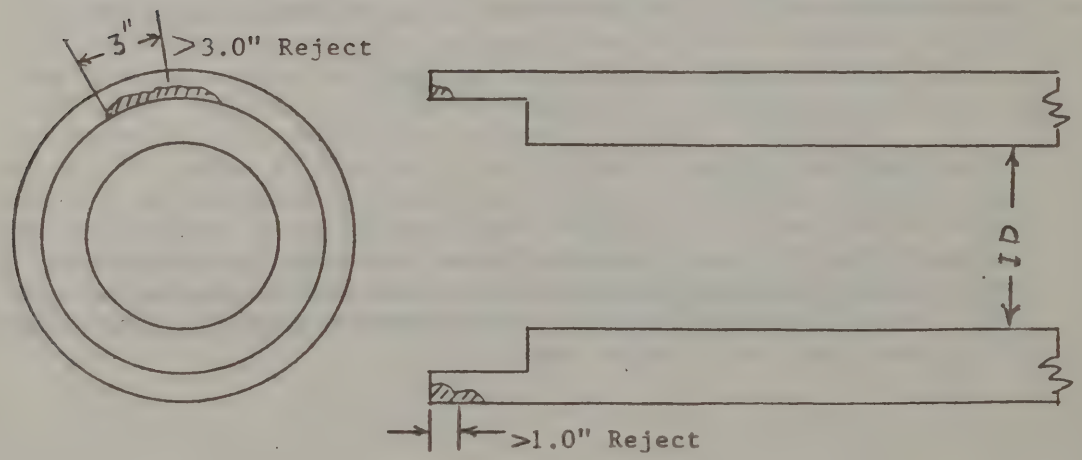
Criteria for Field Inspection of Pipe

1. Pipe Ends

   A. Occasional spalls or chips on the spigots, bell, tongue or groove no greater than 1 inch in the longitudinal direction or 3 inches circumferentially shall not be cause for rejection.

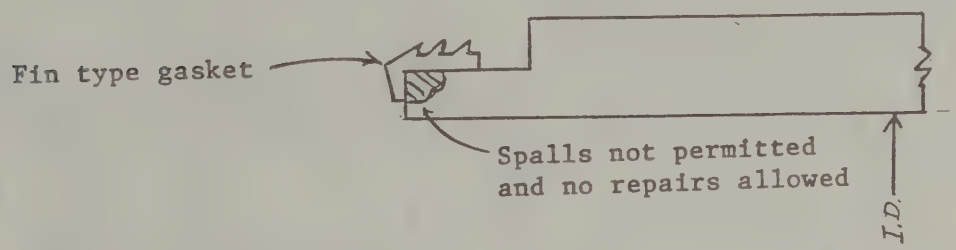
      These spalls need not be repaired unless required for proper jointing or if reinforcing steel is exposed in the joint.

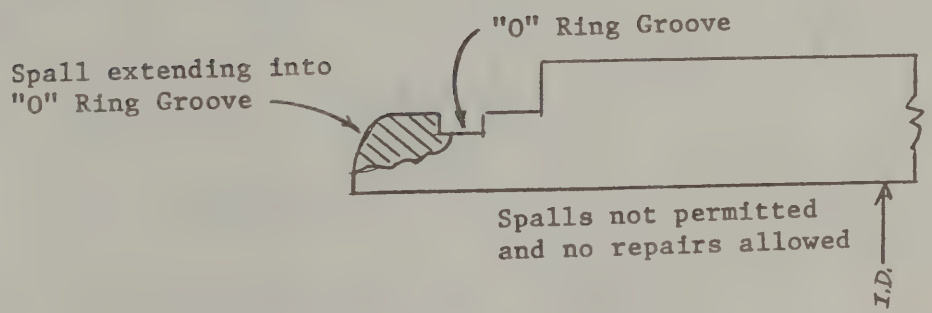




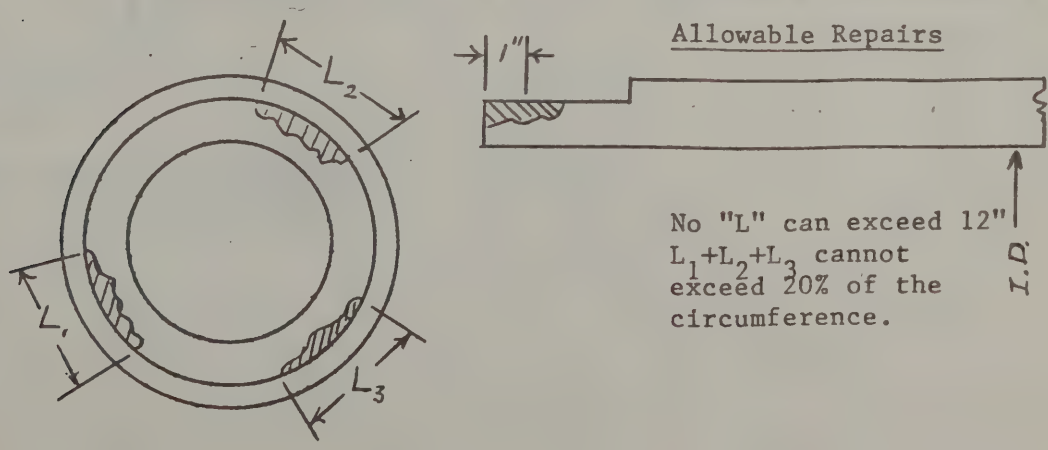
1. (B) When fin type gasket is used for jointing, no spalls on the tongue will be permitted.

Pipes with bells, spigots, tongue or groove having spalls or chips greater than 1 inch in the longitudinal direction or three inches circumferentially shall be rejected.



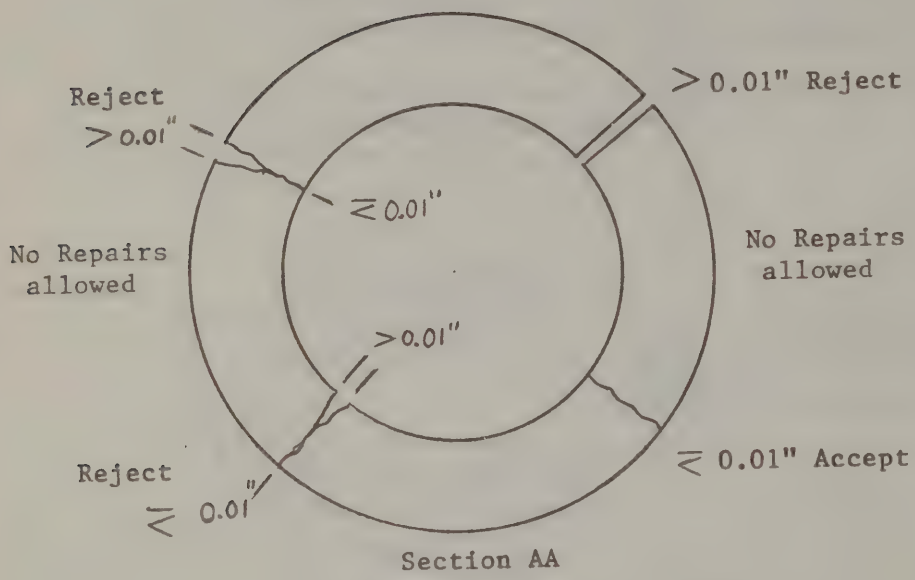


(C) On pipe sections that have been rejected for any of the reasons listed under description of damage, the bells, spigots, tongues and grooves on pipes 24" in diameter and greater may be repaired at either the project or plant site when the total length of spalls on the pipe end is not more than 20% of the total circumference except that no one spall can be greater than 12 inches in length. If spall is repairable, it <u>is</u> repairable even if reinforcing steel is exposed.

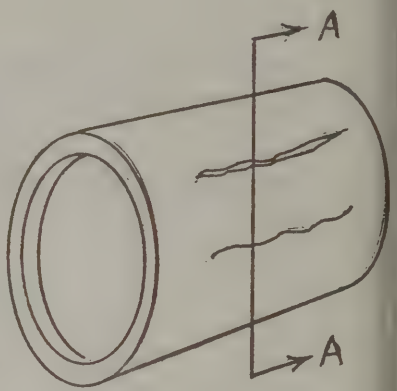


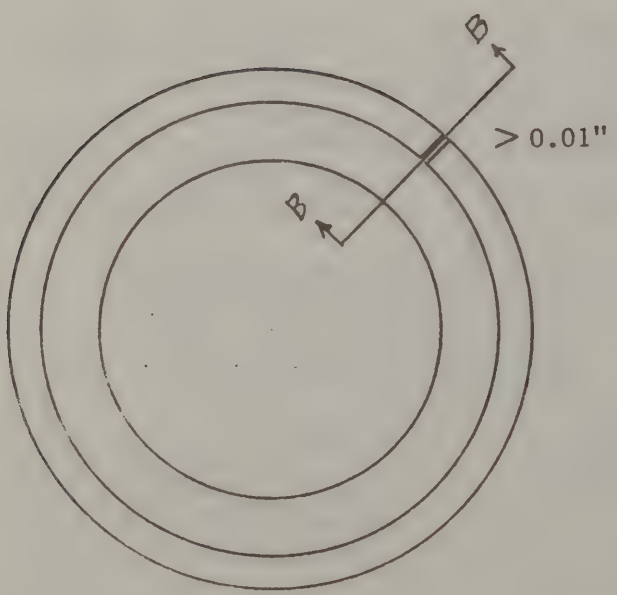
2. (A) Fractures or cracks exceeding 0.01 inch passing through the wall shall be cause for rejection except that a single end crack that does not exceed the depth of the joint will be permissible.

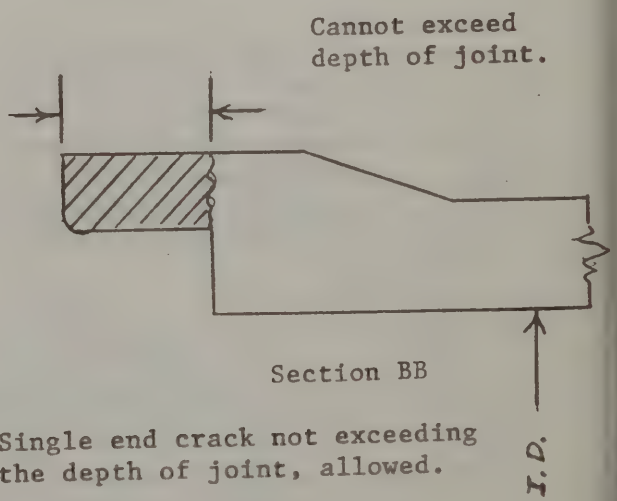
Pipe sections rejected for cracks shall not be repaired.



Section AA



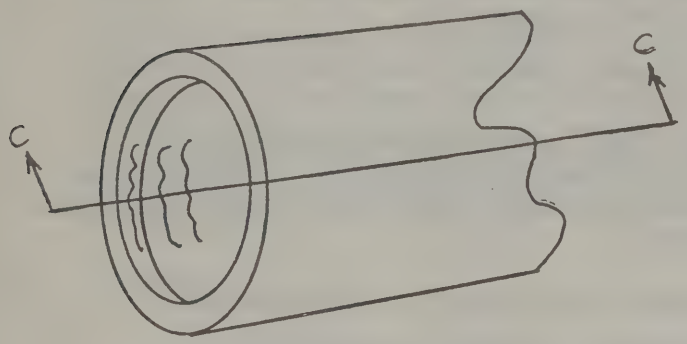


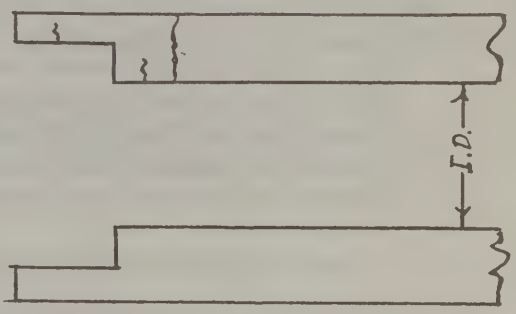


Section BB

Single end crack not exceeding the depth of joint, allowed.

2. (B) Pipe sections having circumferential cracks less than 0.01 inches in width at either end of the pipe section shall be tested on the barrel with a hammer for a "ringing" sound. The ringing sound shall be compared with the sound from an obviously acceptable pipe section. Any section not producing a ringing sound shall be rejected.





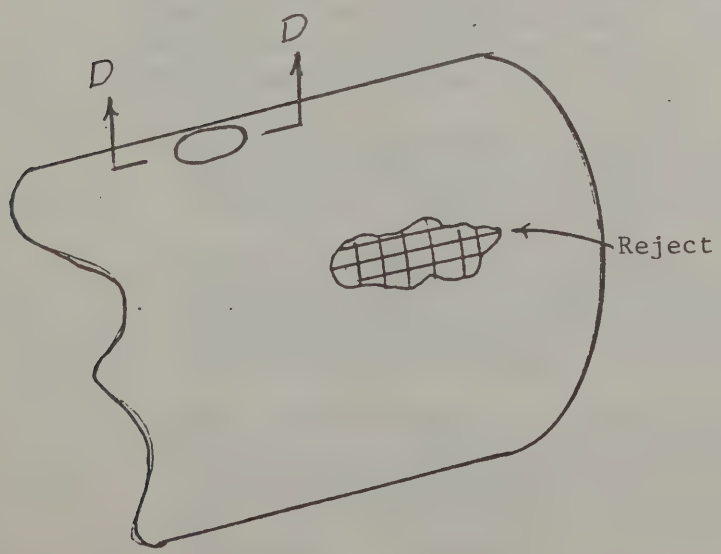
Section CC

Cracks ≤ 0.01"
Sound with hammer - if sound ok - Accept, if not - Reject

3. Spalls (except for damaged pipe ends)

Any spall showing reinforcing steel of the cage shall be rejected and shall not be repaired except that spalls at lifting holes showing reinforcing steel may be repaired.

Minor spalls at the lifting holes may be repaired at the same time the lifting hole is plugged.



Section DD

Accept

4. Manufacturing Defects

Any defect such as honeycombing or concrete mixture problems that cause the reinforcing steel of the cage to be exposed shall be cause for rejection of pipe sections.

Any pipe sections having honeycombing that show the reinforcing steel of the cages shall not be repaired. Minor defects showing steel such as holes caused by sand pockets may be repaired.

5. Reinforcing Steel Cover

The presence of the reinforcing steel pattern showing through the concrete of the pipe barrel is not cause for rejection. If the EIC is concerned about the proper cover, he should advise the Regional Materials Engineer for further investigation.

Pipe sections rejected for improper cover shall not be repaired.

NOTES:

1. When pipe sections are rejected, the Inspector shall document in his records the following information concerning the sections: Manufacturer, date of manufacture, lot number, size, quantity and reason for rejection (i.e., 4 pieces due to broken bells, 2 pieces due to cracks, etc.)

2. Repairs to pipe sections shall be checked to see that they are sound, properly finished and cured. A moderate blow with a 16 ounce hammer is deemed a proper soundness test. Any repair withstanding this test shall be considered acceptable.

Appendix No. 10

TEST METHOD

Determination of the area of reinforcement in reinforced concrete pipe.

SCOPE

This method details the procedure used by Plant Inspectors to verify the minimum reinforcement (square inches of steel per linear foot of pipe barrel) conforms to the requirements of the Department approved drawings. The verification may include the evaluation of reinforcement prior to the manufacture of pipe or the evaluation of the nominal reinforcement sizes detailed on the Manufacturer's Certification to verify they meet the requirements.

APPARATUS

1. A micrometer capable of measuring the diameter of the steel wire in welded wire fabric to the nearest one-thousandth of an inch.
2. A ruler, capable of measuring to the nearest 1/16 inch, to be used to measure the spacing between the wires of the welded wire fabric.
3. A wire size comparison chart similar to that included in this method on page 71 to be used to determine the area of reinforcement supplied by a wire of a given diameter.
4. Copies of the Department approved working drawings for the pipe to be manufactured. These drawings will be used to identify the area of reinforcement per linear foot specified to be present in the pipe.

PROCEDURE

1. When the Plant Inspector verifies the minimum reinforcement prior to the placing of the welded wire fabric in the forms, he must determine the diameter of, and spacing between, the circumferential and longitudinal wires in the cage. The circumferential wire of the cage is that wire which will run around the circumference of the finished pipe unit. The longitudinal wire of the cage is that wire which will run the length of the pipe from the bell to the spigot in the longitudinal direction.

   A. Using the tape measure or ruler, measure the center-to-center distance between a reasonable number of circumferential and longitudinal wires in a reasonable number of cages.

   B. Using the micrometer, measure the diameter, to the nearest one-thousandth of an inch, of a reasonable number of circumferential and longitudinal wires in a reasonable number of randomly selected cages.

   C. Take the diameters of the circumferential and longitudinal wires which were determined above and find the corresponding nominal wire diameter and W size number of each. This shall include the use of the diameter tolerances listed in the column "Permissible Variation in Diameter".

Note: An example of a measured diameter is 0.193". Using the wire comparison chart with the tolerance range, a W2.9 has a diameter of 0.192" with a tolerance of ±0.003" and a W3 has a diameter of 0.195" with a tolerance of ± 0.003". The measured diameter of 0.193" would therefore conform to the Manufacturer's certified diameter of either a W2.9 or W3. All further calculations to determine minimum area of reinforcement will be based upon the nominal diameter i.e. 0.192" for wire certification as W2.9 or 0.195" for wire certified as W3.

2. Compare the spacing and W size number of the circumferential and longitudinal wires to those indicated on the Manufacturer's Certification.
Note: An example of a certified cage would be 2x6 W3 x W3.5 where the circumferential wire, listed first, is W3 (0.195" in diameter) with 2" spacing and the longitudinal wire, listed second, is W3.5 (0.211" in diameter) with 6" spacing.

   A. If the reinforcement is determined not to conform to that certified by the Manufacturer, the Plant Inspector shall notify the Manufacturer, who shall discontinue production of pipe with the use of that cage, until appropriate corrections are made. If it is determined that pipe was manufactured with reinforcement of an area per linear foot of pipe barrel less than detailed on the Department approved drawings, that pipe shall <u>not</u> be considered for acceptance.

   B. If the reinforcement is determined to agree with the size identified by the Manufacturer, the Plant Inspector will continue with the evaluation of the reinforcement as detailed below.

   Note: The remainder of the method requires that only the circumferential wire be evaluated. The purpose of the longitudinal wire is to hold the circumferential wire in the proper position during the manufacture of pipe. The minimum area of reinforcement as specified is therefore determined on the circumferential wire only.

3. Using the chart on page 71, find the area of the circumferential wire detailed on the Manufacturer's Certification.

4. Using the formula below, substitute the appropriate values in the correct parts of the formula and obtain <u>the area of reinforcement supplied by this welded wire fabric in square inches per linear foot</u>.

$$\text{AREA OF REINFORCEMENT} = \frac{12.0}{\text{CIRCUMFERENTIAL SPACING}} \times \text{AREA OF WIRE}$$

5. Compare the value you arrived at with that indicated on the approved working drawing and determine whether or not the welded wire fabric utilized meets the specifications indicated on the drawing.

EXAMPLE ONE

The Manufacturer's Certification details the reinforcement of the pipe as follows:

Reinforcement 2 x 6 W3 x W3.5 Manufactured by Ace Wire Corp., Pittsburgh, PA

Step 1

a. Circumferential spacing = 2"
b. Circumferential wire size = W3

Step 2

Using the wire size comparison chart, W3 size wire has an area of 0.03 sq. inches.

Step 3

$$\text{AREA OF REINFORCEMENT} = \frac{12.0}{\text{CIRCUMFERENTIAL SPACING}} \times \text{AREA OF WIRE}$$

" " " $= \frac{12.0}{2.0} \times 0.03$

" " " $= 6.0 \times 0.03$

" " " = 0.18 square inches/linear foot

Step 4

Let's assume this steel is being put in 30" diameter Class III, reinforced concrete pipe and the approved working drawing specifies a minimum area of reinforcement of 0.18 square inches per linear foot. Since this welded wire fabric supplies 0.18 square inches per linear foot, it meets the specification and is acceptable.

EXAMPLE TWO

Let's suppose that the same welded wire fabric supplying 0.18 square inches/linear foot is used in 42" diameter, Class III pipe. All the measurements and calculations would be the same. However, Step 4 would be different since this larger pipe requires more steel per linear foot.

Step 4

Let's assume the approved working drawing for 42", Class III reinforced concrete pipe specifies 0.21 square inches/linear foot of steel reinforcement. Since this cage of welded wire fabric supplies only 0.18 square inches/linear foot, it is unacceptable for use in 42", Class III pipe.

EXAMPLE THREE

Some sizes of pipe contain two cages of welded wire fabric reinforcement, an inner cage and an outer cage. Assume the Manufacturer's Certification contains the following data:

Inner Cage	2x6	W7 x W7.5	Manufactured by	Acme Steel & Wire Marion, Ohio
Outer Cage	3x9	W8 x W8.5	Manufactured by	Acme Steel & Wire Marion, Ohio

	Circumferential Spacing	Circumferential Wire Size
Inner Cage	2"	W7
Outer Cage	3"	W8

The evaluation then continues as follows,

INNER CAGE

$$\text{AREA OF REINFORCEMENT} = \frac{12.0}{2.0} \times 0.07 = 0.42 \text{ sq. in./lf}$$

OUTER CAGE

$$\text{AREA OF REINFORCEMENT} = \frac{12.0}{3.0} \times 0.08 = 0.32 \text{ sq. in./lf}$$

Let's assume these cages are intended for use in 66" diameter, Class III reinforced concrete pipe. The approved working drawing calls for an Inner cage supplying 0.41 sq. in/lf of reinforcement while the Outer cage calls for 0.31 sq. in/lf of reinforcement. Since the cages evaluated above supply 0.42 and 0.32 sq. in/lf respectively, they are acceptable for use in this pipe.

Appendix No. 11

WIRE SIZE COMPARISON

W & D Size Number Smooth	Deformed	Area (sq.in.)	Nominal Diameter (in.)	Permissible Variation In Diameter Plus and Minus (in.)	American Steel & Wire Gage Number
W31	D31	0.310	0.628	0.008	
W30	D30	.300	.618	"	
W28	D28	.280	.597	"	
W26	D26	.260	.575	"	
W24	D24	.240	.553	"	
W22	D22	.220	.529	"	
W20	D20	.200	.504	0.006	
		.189	.490	"	7/0
W18	D18	.180	.478	"	
		.167	.4615	"	6/0
W16	D16	.160	.451	"	
		.146	.4305	"	5/0
W14	D14	.140	.422	"	
		.122	.394	"	4/0
W12	D12	.120	.390	0.004	
W11	D11	.110	.374	"	
W10.5		.105	.366	"	
		.103	.3625	"	3/0
W10	D10	.100	.356	"	
W9.5		.095	.348	"	
W9	D9	.090	.338	"	
		.086	.331	"	2/0
W8.5		.085	.329	"	
W8	D8	.080	.319	"	
W7.5		.075	.309	"	
		.074	.3065	"	1/0
W7	D7	.070	.298	"	
W6.5		.065	.288	"	
		.063	.283	"	1
W6	D6	.060	.276	"	
W5.5		.055	.264	"	
		.054	.2625	"	2
W5	D5	.050	.252	"	
		.047	.244	0.003	3
W4.5		.045	.240	"	
W4	D4	.040	.225	"	4
W3.5		.035	.211	"	
		.034	.207	"	5
W3		.030	.195	"	
W2.9		.029	.192	"	6
W2.5		.025	.177	"	7
W2.1		.021	.162	"	8
W2		.020	.159	"	
		.017	.148	"	9
W1.5		.015	.138	"	
W1.4		.014	.135	"	10

Appendix No. 12

Examples of Form BR240 Sample and Acceptance Transmittal

The Form BR240 will be utilized to document the acceptability of reinforced concrete pipe lots submitted for acceptance consideration and whose testing was witnessed by a Department representative. The Plant Inspector will complete this form along with a record of the results of the Three-Edge-Bearing Test for each lot of pipe submitted for acceptance consideration. Both records should be completed as indicated below and distributed as detailed in the body of the Materials Method. Example 1 illustrates a lot passing the test and Example 2, one failing the Three-Edge-Bearing Test.

Example 1. Acceptance of Pipe

Three-Edge-Bearing Test Results

A. Date of Test 2/14/86
B. Type of Pipe Reinforced Concrete
C. Diameter, Class 24" Cl. IV

	Required	Unit #1 Results	Unit #2 Results	Unit #3 Results
0.01" Crack Load	4000 lbs/lf	4350 lbs/lf		
115% 0.01" Crack Load	4600 lbs/lf			
Ultimate Strength	6000 lbs/lf	6200 lbs/lf		

Did the lot pass the Three-Edge-Bearing Test? (Yes) No
Comments 0.01 crack first seen at 4350 lbs/lf.
Pipe destroyed at 6200 lbs/lf.

John Q. Inspector
Inspector

BR-240a (11/74) SAMPLE AND ACCEPTANCE TRANSMITTAL
NYSDoT MATERIALS BUREAU

SERIAL NO 72466 | DATE REC'D | TEST NO. 86IOK 008

TO: Region 10

'Material Represented by the Sample Described Below Was Accepted

ON 4/3/86 For Item 603.61 Reinforced Concrete Pipe Class IV - 24" Diameter

(Action Official Only When Validated Below By The Materials Bureau)

UPPER PORTION FOR MATERIALS BUREAU ONLY — INSPECTOR TO COMPLETE ALL APPLICABLE BOXES BELOW

16 ADDITIONAL INFO. (SEE INSTRUCTIONS ON REAR)
Working Drawing RCP-6 revision 2

8 'laying length

1. MATERIAL: 24" Cl. IV RCP
2. ITEM NO.: 603.61
3. DATE SAMPLED: 4/3/86
4. CONTRACT NO.:
5. SUPPLIER AND LOCATION: Round Pipe Co., Milltown, NY
6. QUANTITY IN LOT: 400 units 3200 lf
7. LOT NO: 86-8
8. MANUFACTURER AND LOCATION (IF DIFFERENT THAN ABOVE): —
9. BATCH NO:
10. DATE OF MFGR.: 3/20-25/86
11. SAMPLED AT: [ ] MILL [x] PLANT [ ] JOB
12. TYPE: [x] CONTROL SAMPLE [ ] INFO. SAMPLE [ ] BPR SAMPLE [ ] APPROVED LIST MAT. [ ] CERTIFIED MAT
13. SAMPLED FROM: Segregated Stock
14. SAMPLED BY (INCL. DIST NO OR AGENCY): John Q. Inspector
15. CONTRACTOR AND PROJECT LOCATION:
MATERIALS BUREAU VALIDATION: Region 10

RETAIN PINK COPY FOR YOUR RECORDS
FORWARD ALL OTHERS TO MATERIALS BUREAU

Example 2. Rejection of Pipe

Three-Edge-Bearing Test Results

A. Date of Test 2/14/86
B. Type of Pipe Reinforced Concrete Pipe
C. Diameter, Class 24 Cl. IV.

	Required	Unit #1 Results	Unit #2 Results	Unit #3 Results
0.01" Crack Load	4000 lbs/lf	3850 lbs/lf	4200 lbs/lf	4250 lbs/lf
115% 0.01" Crack Load	4600 lbs/lf		-	-
Ultimate Strength	6000 lbs/lf		6200 lbs/lf	5800 lbs/lf

Did the lot pass the Three-Edge-Bearing Test? Yes (No)
Comments First unit failed - 0.01" crack strength less than specified. Unit #2 passes test. Unit #3 - 0.01" crack strength o.k. Ultimate Strength less than specified.

John Q. Inspector
Inspector

BR-240a (11/74) SAMPLE AND ACCEPTANCE TRANSMITTAL
NYSDoT MATERIALS BUREAU

SERIAL NO. T2467 | DATE REC'D. | TEST NO. 86IOK009

TO: Region 10

'Material Represented by the Sample Described Below Was Rejected

ON 4/4/86 For Item 603.61 Reinforced Concrete Pipe Class IV-24" Diameter REASON: Lot failed three-edge-bearing test

(Action Official Only When Validated Below By The Materials Bureau)

UPPER PORTION FOR MATERIALS BUREAU ONLY — INSPECTOR TO COMPLETE ALL APPLICABLE BOXES BELOW

16 ADDITIONAL INFO. (SEE INSTRUCTIONS ON REAR)
Working Drawing RCP-6 revision 2

8' laying length

1. MATERIAL: 24" Cl. IV RCP
2. ITEM NO: 603.61
3. DATE SAMPLED: 4/4/86
4. CONTRACT NO.: -
5. SUPPLIER AND LOCATION: Round Pipe Co., Milltown, NY
6. QUANTITY IN LOT: 200 units 1600lf
7. LOT NO: 86-9
8. MANUFACTURER AND LOCATION (IF DIFFERENT THAN ABOVE): —
9. BATCH NO: -
10. DATE OF MFGR.: 3/25-26/8
11. SAMPLED AT: [ ] MILL [✓] PLANT [ ] JOB
12. TYPE: [✓] CONTROL SAMPLE [ ] INFO SAMPLE [ ] BPR SAMPLE [ ] APPROVED LIST MAT. [ ] CERTIFIED MAT.
13. SAMPLED FROM: Segregated Stock
14. SAMPLED BY (INCL. DIST. NO. OR AGENCY): John Q. Inspector
15. CONTRACTOR AND PROJECT LOCATION:
MATERIALS BUREAU VALIDATION: Region 10

RETAIN PINK COPY FOR YOUR RECORDS
FORWARD ALL OTHERS TO MATERIALS BUREAU

Appendix No. 13

Example of Properly Completed BR97,
Shipment Certification

Below is a copy of a properly completed BR97, Shipment Certification.

BR 97e (3/73)

SHIPMENT CERTIFICATION

TO;

NEW YORK STATE DEPARTMENT OF TRANSPORTATION

REGION NO. [ ] (Leave blank)

Plant Location: Milltown, NY

Date of Shipment: April 3 19 86

Date Executed: April 3 19 86

This is to certify that on this date the following NYSDOT accepted material was shipped to the following NYSDOT project.

Contractor: ABC Contracting Co. Dept. Contract No. D 500123

Geographic Destination: Colonie, NY County: Albany

Material	Test No.	Date Acc.	Lot No.	Item No.	Vehicle Type & No.	Size	Quantity & Unit
Reinf. Conc. Pipe	8610K008	4/3/86	86-8	603.61	Lic. No. 1186-BCE	24"	8-8' units

Manufactured by: (if different than supplier)

Supplier's Name: Round Pipe Co.

Signed: James Q. Producer

SHIPMENT VALIDATION
(for use by NYSDOT when required)
Data relative to this shipment has been verified by this office.

DIST: WHITE – WITH SHIPMENT
YELLOW – MATERIALS BUR.
PINK – MATERIALS BUR.
GOLD – SHIPPER RETAINS

Appendix No. 14

Example of Properly Completed BR240 For Reinforced Concrete Pipe End Sections

BR-240a (11/74) SAMPLE AND ACCEPTANCE TRANSMITTAL NYSDoT MATERIALS BUREAU

SERIAL NO 1240 | DATE REC'D | TEST NO

TO:

'Material Represented by the Sample Described Below Was

ON For

(Action Official Only When Validated Below By The Materials Bureau)

UPPER PORTION FOR MATERIALS BUREAU ONLY — INSPECTOR TO COMPLETE ALL APPLICABLE BOXES BELOW

16. ADDITIONAL INFO (SEE INSTRUCTIONS ON REAR)

10 End Sections in Lot
18" diameter – 4
24" diameter – 4
30" diameter – 2

1. MATERIAL: RCP End Sections
2. ITEM NO: 603.73
3. DATE SAMPLED: 4/4/86
4. CONTRACT NO: —
5. SUPPLIER AND LOCATION: Round Pipe Co., Milltown, NY
6. QUANTITY IN LOT: 10 End Sections
7. LOT NO: 86-5
8. MANUFACTURER AND LOCATION (IF DIFFERENT THAN ABOVE): —
9. BATCH NO: —
10. DATE OF MFGR.: 3/10-20/86
11. SAMPLED AT: ☐ MILL ☑ PLANT ☐ JOB
12. TYPE: ☑ CONTROL SAMPLE ☐ INFO. SAMPLE ☐ BPR SAMPLE ☐ APPROVED LIST MAT ☐ CERTIFIED MAT.
13. SAMPLED FROM: Segregated Stock
14. SAMPLED BY (INCL DIST NO OR AGENCY): John Q. Inspector
15. CONTRACTOR AND PROJECT LOCATION:
MATERIALS BUREAU VALIDATION: Region 10

RETAIN PINK COPY FOR YOUR RECORDS
FORWARD ALL OTHERS TO MATERIALS BUREAU

Appendix No. 15

INSTRUCTIONS:

1. Determine number of digits to be used that correspond with number of units to be sampled. (e.g. 500 units - use last three digits of each number in the table - 9685)

2. Starting anywhere in the table, select the units to be sampled by reading the numbers consectively that do not exceed total number of units in the lot.

(EXAMPLE - 500 units to be sampled with 5 samples needed. Presume you start on line 27, column 3 (#685). Since 685 is larger than the number of units in lot, go down col. 3 selecting numbers 64, 32, 187, 37 and 110. When counting units in lot, those units corresponding to these numbers would be sampled.)

RANDOM NUMBER TABLE

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
1.	1305	1189	5731	3968	5606	5084	8947	3897	1536	7810
2.	0422	2431	0649	8085	5053	4722	6598	5044	9040	5121
3.	6597	2022	6168	5060	8656	6733	6364	7649	1871	4328
4.	7965	6541	5645	6243	7658	6903	9911	5740	7824	8520
5.	7695	6937	0406	8894	0441	8135	9797	7285	5905	9539
6.	5160	7851	8464	6789	3938	4197	6511	0407	9239	2232
7.	2961	0551	0539	8288	7478	7565	5581	5771	5442	8761
8.	1428	4183	4312	5445	4854	9157	9158	5218	1464	3634
9.	3666	5642	4539	1561	7849	7520	2547	0756	1206	2033
10.	6543	6799	7454	9052	6689	1946	2574	9386	0304	7945
11.	9975	3080	7423	3175	9377	6951	6591	8287	8994	5532
12.	4866	0956	7545	7723	8085	4948	2228	9583	4415	7065
13.	8239	7068	6694	5168	3117	1586	0237	5160	9585	1133
14.	8722	9191	3386	3443	0434	4586	4150	1224	6204	0937
15.	1330	9120	8785	8382	2929	7089	3109	6742	2468	7025
16.	2296	2952	4764	9070	6356	9192	4012	0618	2219	1109
17.	3582	7052	3132	4519	9250	2486	0830	8472	2160	7046
18.	5872	9207	7222	6494	8973	3545	6967	8490	5264	9821
19.	1134	6324	6201	3792	5651	0538	4676	2064	0584	7996
20.	1403	4497	7390	8503	8239	4236	8022	2914	4368	4529
21.	3393	7025	3381	3553	2128	1021	8353	6413	5161	8553
22.	1137	7896	3602	0060	7850	7626	0854	6565	4260	6220
23.	7437	5198	8772	6927	8527	6851	2709	5992	7383	1071
24.	8414	8820	3917	7238	9821	6073	6658	1280	9643	7761
25.	8398	5224	2749	7311	5740	9771	7826	9533	3800	4553
26.	0995	8935	2939	3092	2496	0359	0318	4697	7181	4035
27.	6657	0755	9685	4017	6581	7292	5643	5064	1142	1297
28.	8875	8369	7868	0190	9278	1709	4253	9346	4335	3769
29.	8399	6702	0586	6428	7985	2979	4513	1970	1989	3105
30.	6703	1024	2064	0393	6815	8502	1375	4171	6970	1201
31.	4730	1653	9032	9855	0957	7366	0325	5178	7959	5371
32.	8400	6834	3187	8688	1079	1480	6776	9888	7585	9998
33.	3647	8002	6726	0877	4552	3238	7542	7804	3933	9475
34.	6789	5197	8037	2354	9262	5497	0005	3986	1767	7981
35.	2630	2721	2810	2185	6323	5679	4931	8336	6662	3566
36.	1374	8625	1644	3342	1587	0762	6057	8011	2666	3759
37.	1572	7625	9110	4409	0239	7059	3415	5537	2250	7292
38.	9578	2877	7579	4935	0449	8119	6969	5383	1717	6719
39.	0882	6781	3538	4090	3092	2365	6001	3446	9985	6007
40.	0006	4205	2389	4365	1981	8158	7784	6256	3842	5603
41.	4611	9861	7916	9305	2074	9462	0254	4827	9198	3974
42.	1093	3784	4190	6332	1175	8599	9735	8584	6581	7194
43.	3374	3545	6865	8819	3342	1576	2264	6014	5012	2458
44.	3650	9676	1436	4374	4716	5548	8276	6235	6742	2154
45.	7292	5749	7977	7602	9205	3599	3880	9537	4423	2330
46.	2353	8319	2850	4026	3027	1708	3518	7034	7132	6903
47.	1094	2009	8919	5676	7283	4982	9642	7235	8167	3366
48.	0568	4002	0587	7165	1094	2006	7471	0940	4366	9554
49.	5606	4070	5233	4339	6543	6695	5799	5821	3953	9458
50.	8285	7537	1181	2300	5294	6892	1627	3372	1952	3028

From D. B. Owen's Handbook of Statistical Tables, 1962, Addison-Wesley, Reading, Mass., courtesy of the U. S. Atomic Energy Commission.

01458
LRI